SECTION V

SNEP Case Studies

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The Mammoth-June Ecosystem Management Project, Inyo National Forest

ABSTRACT

The Sierra Nevada Ecosystem Project (SNEP) case-study assessment of the Mammoth-June Ecosystem Management Project (MJEMP) was undertaken to review and analyze the efficacy of a local landscape analysis in achieving ecosystem-management objectives in the Sierra Nevada. Of primary interest to SNEP was application of the new U.S. Forest Service (USFS) regional process for landscape analysis, especially use of historic and natural range of variability. An underlying assumption in current USFS approaches is that managing lands within historical and natural ranges of variability will promote ecological sustainability. Another assumption of interest to SNEP is that social goals can be incorporated into ecological goals to arrive at integrated management objectives. Success in describing historical condition varied considerably by ecological indicator. A few quantitative measures were developed for short- (decade) to medium-term (several centuries) periods, but many descriptions were qualitative, highly inferential, and based on very short-term studies. If the intent were to develop desired conditions from scientifically defensible, quantitative descriptions of historical variabilities, the MJEMP analyses would be inadequate; the team found that it was difficult to take a science-based approach when there was not time, budget, or qualifications to do the science. For the MJEMP team, however, the value of historic data was not to develop a desired condition that mimicked past structural conditions, but to be informed about natural processes and how they can be severely disrupted by human activities (present and past). Thus, the information obtained by the MJEMP was useful for describing the status, trends, and apparent changes in successional pathways caused by humans. Without detailed information about historic ranges of conditions, however, the team had difficulty describing desired future conditions, finding it oversimplified to say they wanted to maintain natural or current conditions.

Public involvement in the MJEMP was at first low to moderate, but built to strong participation and interest. However, a segment of the local public expressed dissatisfaction with the general USFS approach to landscape analysis and the specific implementation in the Mammoth-June area, and began to mount legal action against it. The main concern of this group is that the landscape analysis is actually a decision process, yet it has been considered exempt from (or outside of) National Environmental Policy Act procedures. The outcome of these discussions could have implications for landscape analysis on national forests throughout the Sierra Nevada.

INTRODUCTION

The Sierra Nevada Ecosystem Project (SNEP) is primarily an assessment study. In addition to assessing ecological and sociological conditions and trends in the Sierra Nevada, SNEP is charged with assessing relevant methods, approaches, and policies. This direction includes both methods that SNEP itself uses and also policies and approaches to ecosystem management potentially or actually employed by others in the Sierra Nevada. For this reason, five SNEP case studies were chosen as ongoing examples of ecosystem management in the Sierra Nevada.

The case studies illustrate diverse conditions in the Sierra Nevada and do not parallel one another in intent, histories, magnitude, funding, or other attributes. Each exemplifies a particular approach to common institutional problems encountered in ecosystem management of the Sierra Nevada. Collectively they sample many significant situations encountered in ecosystem management. SNEP will evaluate the effi-

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cacy of these approaches to the physical and biological communities each represents, to the human communities involved, for value to SNEP in its analyses, and for their value in wider application of these approaches in the Sierra Nevada.

Case-Study Objectives

Each of the three SNEP assessment questions pertains to analysis of SNEP case studies. In addition, because most have involved some form of projecting and evaluating land-management alternatives, they also represent approaches to SNEP's questions about policy scenarios. These issues are woven into five questions that pertain directly to each case study:

1. What conditions does this case study represent for ecosystem management in the Sierra Nevada? Conditions of interest include natural and social environment, land-ownership patterns, current land-management objective, historical use and policies, nature of public involvement, and policy context.
2. What are the specific ecosystem management methods, approaches, or policies being applied? These include intended, planned, actual, and implemented methods, as well as biological and social aspects.
3. How effective have these specific methods been in reaching goals? Effectiveness is assessed relative to the natural (physical conditions, biodiversity) and social (local communities, interest groups, common good) environments.
4. How representative of other situations in the Sierra Nevada is the case study?
5. What can be learned from the case study? Specifically, what are the implications for local conditions (both the local natural environment and local human communities), for SNEP, and for broader application in the Sierra Nevada?

Mammoth-June Case-Study Objectives

The Mammoth-June Ecosystem Management Project (MJEMP) of the Inyo National Forest was selected by SNEP because it meets the preceeding conditions and exemplifies a set of representative issues in Sierra Nevada ecosystem management. The MJEMP

- Represents eastern Sierra landscape and management conditions in
  - patterns of land ownership (almost exclusively federal)
  - focus on recreation and habitat protection with diverse but low intensity commodity values
  - forest structure and composition with associated physical and biotic environment
  - competing and conflicting desires for management of parts of the area
  - active public involvement
  - relatively strong scientific information base
- Applies new U.S. Forest Service (USFS) guidelines for ecosystem management, both national policy (Forest Plan Implementation, USFS 1992a), and Pacific Southwest regional approach (Manley et al. 1995). These guidelines contain the conceptual thinking and procedural models that are to be adopted by and guide land-management planning on the national forests across the country and throughout the Sierra Nevada in the future.
- Relies on comparisons of current conditions to inferred historical conditions (especially natural ranges of variability and ecological indicators) to arrive at ecological management goals. It assumes (explicit in Manley et al. 1995) that landscapes managed within relevant natural range of variabilities are sustainable.
- Assumes that social desires can be accommodated by modifying ecological goals to arrive at integrated management objectives for the landscape (desired conditions).

METHODS AND ASSUMPTIONS

SNEP's approach to assessing the MJEMP was primarily observation by participation, interview, and review of secondary sources. SNEP scientists involved have ongoing experience independent of SNEP in the eastern Sierra, the Inyo National Forest, and especially the Owens River headwaters region. Each has a history of research and management interest in the area and has participated to some degree in management processes for the area in recent years. By participating in the meetings and field trips of the MJEMP team, through interviews and informal discussion with team members and members of the public, and through working in residence in the eastern Sierra, SNEP scientists were directly involved (although to varying degrees) from the beginning of the current Mammoth-June project.

Several explicit assumptions are accepted:

1. MJEMP reflects general approaches (e.g., Grumbine 1994) being taken in land management.
2. MJEMP is a serious attempt to adopt the specific steps outlined in the national Forest Plan Implementation (USFS 1992a) and the new regional ecosystem management manual (Manley et al. 1995) and thus reflects a process that may be repeated commonly throughout Sierra Nevada national forests.

3. MJEMP is one of the first landscape analyses in the Sierra Nevada to implement these specific national and regional guidelines at the landscape or watershed scale.
4. The conditions local to the Mammoth-June landscape are not unique nor so unusual as to limit application of lessons learned there for landscape analyses elsewhere in the Sierra Nevada.
5. Knowledge and experience gained at the scale of Mammoth-June (14,750 ha [36,000 acres]) are relevant to landscape analyses and ecosystem management analyses at other scales in the Sierra Nevada.
6. By choosing to evaluate historical conditions, natural ranges of variation, and their application to desired conditions, SNEP does not necessarily endorse the concept. Rather, because this concept is so widely promoted and discussed in conservation biology and restoration ecology communities, SNEP felt it important to evaluate its application in a Sierran case study.

BACKGROUND: ECOSYSTEM MANAGEMENT

General Context

Within only a few years ecosystem management has taken on almost symbolic meaning in social, political, management, and scientific communities. Although scientists and analysts alike debate the nature of ecosystem management, some elements that are common to its philosophical and conceptual bases can be summarized as follows (Grumbine 1994, references in Duane 1994):

- maintain viable populations of all native species in situ
- represent, within protected areas, all native ecosystem types across their native range of variation
- maintain evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles)
- manage over periods of time long enough to maintain the evolutionary potential of species and ecosystems
- accommodate human use and occupancy within these constraints

Forest Service Interpretations

The USFS has evolved its own lexicon and interpretations for ecosystem management. Because landscapes in the Sierra Nevada are predominantly influenced by management decisions of the national forests, interpretations specific to the USFS are widely relevant to the Sierra, and hence, to SNEP. Ecosystem management is the current theme guiding USFS land management. In June 1992, the chief of the USFS instituted ecosystem management throughout the national forests of the United States and defined it as "the skillful, integrated use of ecological knowledge at various scales to produce desired resource values, products, services, and conditions in ways that also sustain the diversity and productivity of ecosystems" (Robertson 1992). Further emphasized have been sustainability of resilient ecosystems, restoration and maintenance of ecological conditions; production of desired resource uses within the capabilities of ecosystems; aesthetic, cultural, and spiritual values; and collaboration internally, among agencies, and with diverse publics. Goals are healthy ecosystems, vital human communities, and organizational effectiveness (Robertson 1994).

The USFS recognizes ecosystem management as a "means not an end, scientifically credible, legally defensible, and socially accepted" (Manley et al. 1995) . The focus for land management is changed from output-driven project planning to outcome-driven planning.

Forest Plan Implementation

Although the USFS emphasizes that ecosystem management, as a means to sustaining healthy ecosystems, cannot be prescriptively assigned, there have been attempts to standardize general approaches and develop manuals and guidelines. Relevant national guidelines, although not explicitly under the ecosystem management banner, have been widely taught under the title of Forest Plan Implementation (USFS 1992a). This approach has an implicit ecosystem management philosophy that is developed through a three-phased approach to implementing national forest land and resource management plans (figure 50.1). An initial landscape analysis phase (National Forest Management Act [NFMA] component) is described at length. This phase involves evaluating existing conditions of the landscape, determining desired conditions relative to the present, and outlining management opportunities, practices, and projects to achieve the desired conditions. The emphasis in these analyses is on ecosystem capacities, limitations, and thresholds, and on determining ecologically and socially acceptable environmental outcomes (not projects). Because these steps constitute analysis and are not decisions affecting land allocations or land disturbance, there is no involvement of National Environmental Policy Act (NEPA 1970) analysis. This interpretation, however, is being challenged within the MJEMP (discussed later in this chapter), with potentially significant implications for the planning process in general.

The second phase occurs when a USFS official selects one or more site-specific management practices to implement within the landscape analyzed as a project. Once an actual project is proposed, it becomes subject to NEPA, calling into play the standard phases of public scoping, issue identification, development of alternatives, environmental effects, significance of impacts, and decision notification. The NEPA

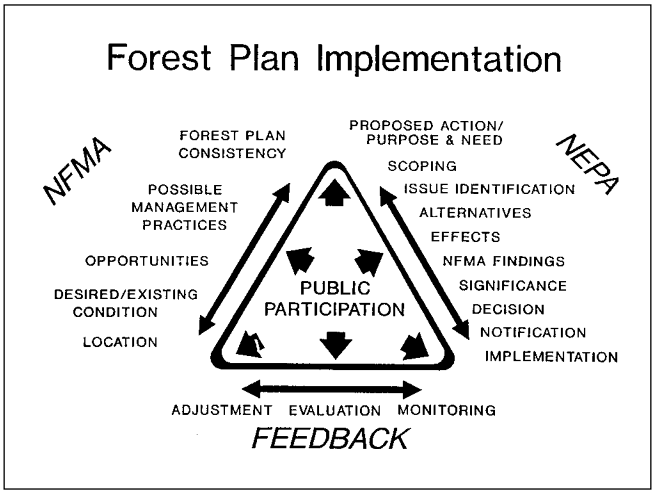


FIGURE 50.1

Three phases of the USFS forest plan implementation guidelines (USFS 1992a).

phase focuses just on the actual project activities proposed as a result of the landscape analysis, not the landscape analysis itself (except for some cumulative effects analyses).

The final phase, adaptive management, uses monitoring to provide feedback between expected results based on the initial NFMA analysis and actual results based on implementation of the NEPA project (figure 50.1). Unexpected or undesired results indicate how the landscape analysis may need to be adjusted.

Public participation is encouraged during all phases of forest plan implementation. Significantly, it is only during the NEPA phase, however, that it is legally required, a formal process is prescribed, and an appeal procedure outlined for some decisions. No prescriptive steps for public participation are outlined for the other phases, although the emphasis is on iterative dialogue with interested members of the public.

The significant change that forest plan implementation effected was the emphasis on an independent, interdisciplinary landscape (ecosystem) analysis prior to determining specific projects. In effect such emphasis implies that managers think first about the whole landscape and only then act on site-specific projects. Traditionally much of the thinking (i.e., landscape analysis) has been forced into evaluations within specific NEPA projects to meet administrative targets (either proposed within the agency or from outside), with the result that analyses have often been hurriedly conducted in response to specific projects. The geographic and scientific scope of these analyses has been constrained by activities and management projects rather than by comprehensive ecological analysis. In effect, forest plan implementation sought to link NFMA analysis with NEPA evaluations to promote more responsible, scientifically defensible, and proactive management planning.

Pacific Southwest Regional Ecosystem Management

Responding to national imperatives to develop regionally appropriate guidelines for ecosystem management, in February 1994 the Pacific Southwest (PSW) Region of the USFS distributed a three-volume draft ecosystem management guidebook (USFS 1994) . The goals of this effort were to (1) develop clear objectives for ecosystem management in the region, (2) define the major ecosystems in the region, as well as their components and functions, and (3) develop a process by which these objectives could be incorporated into planning. The draft guidelines, a subsequent regionwide workshop, and the final version, Sustaining Ecosystems: A Conceptual Framework (Manley et al. 1995) were intended to disseminate and catalyze an approach to ecosystem management that would be implemented in national forests throughout the California (Pacific Southwest) region.

The Pacific Southwest conceptual framework (Manley et al. 1995) builds on the basic three-phase outline of forest plan implementation, but adds scientific (especially ecological) rationale and detail. It embraces the notion that ecosystems are dynamic and evolving in time and over space, and that resilience to disturbance and adaptability to environmental change characterize natural ecosystems. Further, it firmly endorses the notion that the landscapes that will be favored mimic conditions within and across watersheds that have occurred over evolutionary time. The underlying assumption here, widely supported within other USFS regions, is that "restoring and maintaining landscape conditions within distributions that organisms have adapted to over evolutionary time is the management approach most likely to produce sustainable ecosystems" (Manley et al. 1995) .

The basic steps outlined for landscape analysis (figure 50.2) are:

1. Determine which ecosystem elements (components, structures, processes) are key for the landscape under analysis. An element is key if it reflects ecosystem integrity.

2. Identify environmental indicators (previously called ecological indicators) that measure (directly or indirectly) the key ecosystem elements (table 50.1). Selected indicators should take into account both coarse-filter (habitat condition; ecosystem processes) and fine-filter (specific needs of unique elements) aspects.

3. Determine natural ranges of variabilities (in the final version of the guidelines, these are called reference variabilities; also sometimes called historic ranges of variation) for the environmental indicators (figure 50.2). The ranges of variabilities are developed from inferences about historic conditions and/or spatial variability of the ecological indicators at one time.

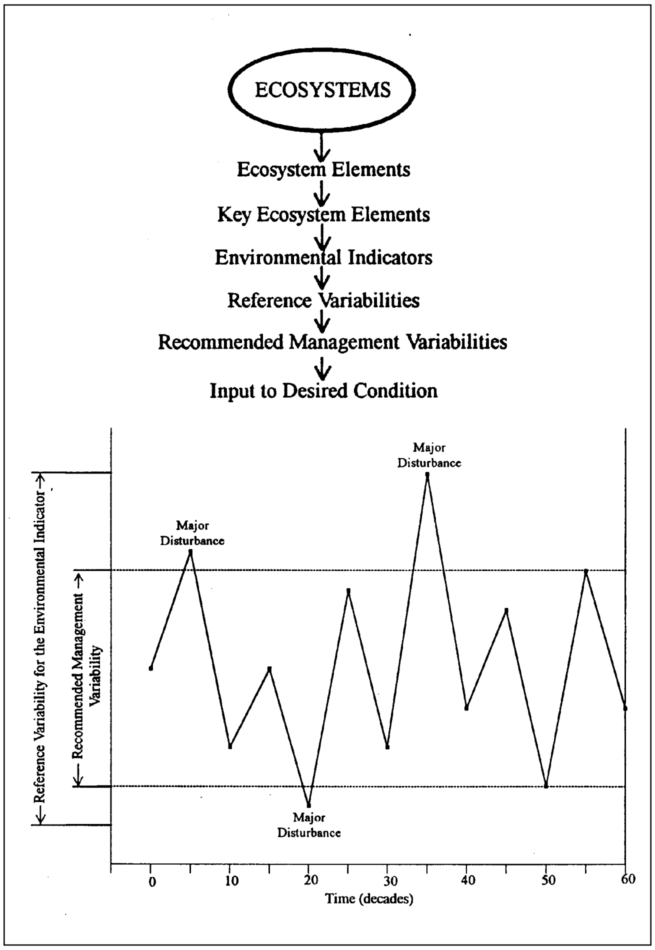


FIGURE 50.2

Steps in the ecosystem management guidelines of the USFS regional guidelines (top) and illustration of reference variability and recommended management variability (bottom). (Manley et al. 1995).

4. Determine recommended management variability (previously called recommended range of variation) for the environmental indicators. This range is the subset of natural (later called reference) range of variability that would set the thresholds for management of each indicator (figure 50.2) by eliminating the extreme events that management would not want to replicate.

5. Develop (or, extract from the forest plan, should it contain an adequate description) the desired condition for the landscape. Desired condition is the portrayal of how the landscape would be if management goals are achieved. Desired conditions reflect an integration of physical, biological, and cultural/social considerations. The desired condition is stated quantitatively for the environmental indicators and ideally lies within the recommended management variability for each indicator.

6. Inventory existing conditions of environmental indicators in the landscape (physical, biological, and cultural/social). Develop a baseline database.

7. Compare desired condition with existing conditions and develop a sequence of potential projects (opportunities) to move the landscape toward the desired condition. (Steps 1-7 approximately encompass phase 1 of forest plan implementation.)

8. Select projects, using NEPA procedures as appropriate.

9. Implement projects according to NEPA procedures. (Steps 8–9 are approximately phase 2 of forest plan implementation.)

10. Invoke adaptive management through monitoring and feedback, to adjust details of analysis, including variabilities, desired conditions, and proposed projects (approximately phase 3 of forest plan implementation).

Through the background material in the conceptual framework, foundations of dynamic ecosystems, the role of historic change, scales of temporal and spatial hierarchies, and discussions about inferring ranges of variabilities are developed. Similarly, an extensive section of the conceptual framework develops and describes sets of key ecosystem elements and indicators for the cultural/social, the hydrological, and the terrestrial hierarchies.

The Mammoth-June Ecosystem Management Project adopted both the forest plan implementation general ap– proach and the landscape analysis of the draft regional guidelines.

THE MAMMOTH-JUNE ECOSYSTEM MANAGEMENT PROJECT

Background and assessment of the MJEMP are discussed here relative to the five questions posed for SNEP case studies.

Question 1. What Conditions Does the MJEMP Represent for Ecosystem Management in the Sierra Nevada?

Physical Setting

Lying entirely within the administrative boundaries of the Inyo National Forest, the 14,570 ha (36,000 acre) land area included in the MJEMP extends from the town of Mammoth Lakes and Highway 203 on the south to June Lake on the north (figure 50.3). The western boundary lies adjacent to the Sierra Nevada crest (San Joaquin Ridge, highest elevation, 3,515 m [11,600 ft]) and the eastern boundary traverses U.S. Highway 395 (lowest elevation, about 2,240 m [7,400 ft]) (figure

TABLE 50.1

Example of environmental indicators (formerly called ecological indicators) showing matrix of key ecosystem elements, terrestrial hierarchy (from USFS regional ecosystem management guidelines, Manley et al. 1995).

Ecosystem Element	Land Unit	Landscape	Subregion	Ecoregion
Vegetation mosaic (structure)	***Description*** vegetation patch(s) identified by similar compositions and structure, each defined as a "series" ***Relevance*** *Cultural/Social Links* all cultural/social elements *Hydrologic Links* hydrologic cycle *Terrestrial Links* animal and plant species (amount of habitat for individuals, fragmentation effects, species composition); erosion ***Affected By*** *Atmospheric Links* climate *Cultural/Social Links* all cultural/social elements *Terrestrial Links* erosion; fire regimes; insect infestations; pathogens and disease; plant species (structural heterogeneity— ***Environmental Indicators*** suitale habitat area (including cover by species); patch size; shape indices; landscape location; pattern analysis (re: gaps); nearest neighbor analysis	***Description*** vegetation patches identified by similar compositions and structure, each defined as a "series" ***Relevance*** *Cultural/Social Links* all cultural/social elements *Hydrologic Links* hydrologic cycle *Terrestrial Links* animal and plan species (amount and arrangement of habitat for individual or populations, fragmentation effects, connectivity, population structure and dynamics); erosion ***Affected By*** *Atmospheric Links* climate *Cultural/Social Links* all cultural/social elements *Terrestrial Links* erosion; fire regimes; insect infestations; pathogens and disease; plant species; soil porductivity; topography ***Environmental Indicators*** total habitat area; suitable habitat area; habitat arrangement; frequency of patch sizes; shape indices; connectivity; fragmentation; subregion location; pattern analysis; frequency of occurrence across the range of potential substrates (re: plant communities)	***Description*** an aggregation of similiar series to simplify complex areas by creating larger patches ***Relevance*** *Cultural Social Links* all cultural/social elements *Hydrologic Links* hydrologic cycle *Terrestrial Links* animal and plant species (amount and arrangement of habitat for populations, fragmentation effects, connectivity, population structure and dynamics) ***Affected By*** *Atmospheric Links* climate *Cultural/Social Links* all cultural/social elements *Terrestrial Links* fire regimes; insect infestations; pathogens and disease; plant species; soil types; typography ***Environmental Indicators*** total bahitat area; suitable habitat area; habitat arrangement; frequency of patch sizes; fragmentation; connectivity; ecoregion location; pattern analysis; frequency of occurrence accross the range of potential substrates (re: plant communities)	***Description*** an aggregation of similar series to simplify complex areas by creating larger patches ***Relevance*** *Cultural Social Links* all cultural/social elements *Hydrologic Links* hydrologic cycle *Terrestrial Links* animal and plant species (amount and arrangement of habitat for populations, fragmentation effects, connectivity, population structure and dynamics) ***Affected By*** *Atmospheric Links* climate *Cultural/Social Links* all cultural/social elements *Terrestrial Links* fire regimes; insect infestations; pathogens and disease; plant species; soil series; topographic variation ***Environmental Indicators*** total habitat area; suitable habitat area; habitat arrangement; fragmentation; connectivity; pattern analysis frequency of occurrence across the range of potential substrates (re: plant communities)

50.3). The area is about 120 km (45 mi) north of Bishop and about 25 km (10 mi) south of the Mono Basin.

Included within the boundaries of the Mammoth-June area (MJ area) are the entire upper watersheds of Glass Creek and Deadman Creek, and all but the uppermost portion of the upper Dry Creek watershed. Lands at the south extend slightly into the Mammoth Creek watershed, where the landscape abuts the town of Mammoth Lakes. These permanent streams have significant value as the headwaters of the Owens River, the dominant watershed of the eastern Sierra.

Geologically and topographically the area differs from adjacent eastern Sierran escarpment environments. The Sierran crest is a relatively low ridge in this region and does not dominate as a weather or migration barrier as it does north and south of the area. The lands east of the crest within the MJ area have relatively gentle topography, although several mountains and low buttes lie east of the crest within the area. Whitewing Mountain (3,035 m [10,014 ft]), situated in the middle of the MJ area, is the largest. The southernmost six Inyo Craters form a north-south chain within the area (Deer Mountain has a maximum elevation of 2,665 m, [8,796 ft]). Repeated explosions from the craters (as recently as 530–650 years ago) dispersed volcanic ash, tephra, and lava over portions of the area, and have been important periodic forest and landscape disturbance agents (Miller 1985; Sieh and Bursik 1986; Wood 1977).

About three-quarters of the MJ area is forested. Significant are the extensive red fir (Abies magnifica) forests that cover

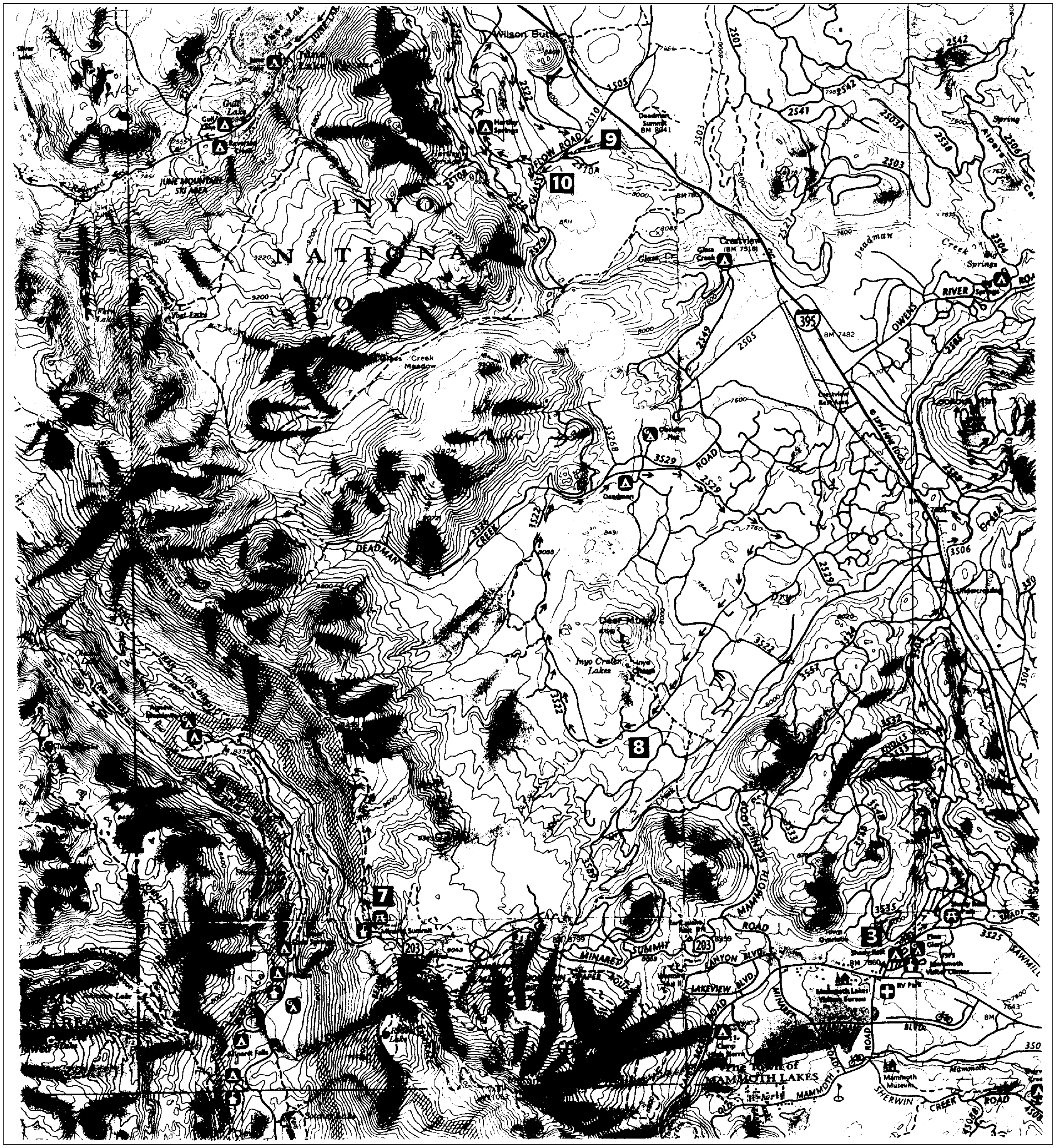


FIGURE 50.3

Map of the Mammoth-June landscape.

much of the western portions of the area. Red fir is infrequent east of the Sierran crest, occurring elsewhere only as scattered trees or small groves south of the Tahoe area. The red fir forest within the MJ area, however, exists not only in mixed associations with other montane conifers (predominantly Jeffrey pine [Pinus jeffreyi] and lodgepole pine [P. contorta]), but also in pure red fir associations, which are very rare in the eastern Sierra. Many of these forest stands have late successional characteristics and are valued from many standpoints for their old-growth conditions.

Below the pure red fir forests are mixed montane forests (red fir, Jeffrey pine, lodgepole pine, white fir [Abies concolor], western juniper [Juniperus occidentalis]) locally dominated by single species where soils and other conditions limit diversity (e.g., pure lodgepole pine stands in some areas). Toward the eastern edges of the area, especially in the Dry Creek drainage, extensive stands of Jeffrey pine (locally mixed with other conifers) dominate.

Above the red fir forests are montane and subalpine forests of western white pine (Pinus monticola), whitebark pine (P. albicaulis), mountain hemlock (Tsuga mertensiana), lodgepole pine, western juniper, and possibly limber pine (Pinus flexilis). Scattered subalpine forests, alpine meadows, scree slopes, and barren rock occur in the higher reaches.

Openings in the forested and nonforested areas occur throughout the MJ area. The most important meadow complex are the Glass Creek Meadows in the northern portion of the area. Comprising both wet and dry components, this area is rich in shrubs, forbs, grasses, and sedges. Sand flats occur in some areas around the crater, and influence vegetative development. In the eastern part of the area, the forest meets an ecotone with sagebrush (Artemesia tridentata)/bitterbrush (Purshia tridentata) associations, which extend eastward through Long Valley.

Understory plant diversity in the area is rich. Species occur in this area that have affinities to at least seven floristic zones, including areas of the western Sierra and assemblages in low abundance in the xeric eastern Sierra (Constantine 1994). The low elevation of the Sierran crest appears to contribute to this diversity as a corridor for plant migration.

The unusual occurrences and mixes of forest types and nonforest associations (especially mesic types) in this area provide important habitat for wildlife in the semiarid eastern Sierran bioregion. As it did for plants, the low elevation of the Sierran crest in this region appears to have served historically and at present as a trans-Sierran corridor for some wildlife. Major vertebrates of importance are furbearers, especially marten and possibly wolverine, whose prime habitats are the red fir forests. The MJ area is a significant mule deer migration area, offering important summer habitat and fawning areas. Raptors are important, especially goshawks. Although no California spotted owls have been found in the MJ area (or anywhere else on the Inyo National Forest east of the Sierran crest), they have been sighted closely adjacent in the upper San Joaquin drainage, and the MJ area may serve as occasional foraging habitat. Willow flycatcher and other neotropical migrants may use Glass Creek Meadows and other meadows in the area.

The aquatic fauna is also rich by eastern Sierran standards. Glass Creek Meadows supports a diverse herptofauna, including the endangered Yosemite toad. Although no natural salmonids occur in the Upper Owens River Basin, Glass Creek and Deadman Creek support permanent populations of exotic trout. Glass Creek is part of the California Department of Fish and Game's Lahontan trout restoration plan, even though the trout is not known to be native to the stream.

Landscape disturbance in the forested areas historically was most frequently caused by fire, insects, and disease. Fire influence and effect in the pre-suppression era varied by forest type (discussed later in this chapter). Fire appears to have been most common in the Jeffrey and lodgepole pine forests. Fire intervals were much longer in the red fir forests, where the range of fire-return times could be quite long and where stand-replacing fires did occur, although not exclusively. The role of fire in the sagebrush/bitterbrush types is less clear. Fires were probably uncommon in the meadows and only very local in the high elevations.

Insects and disease contribute to forest structure in most of the forest types, acting alone and interacting with other disturbances. Bark beetles have caused significant mortality recently in both pine and fir types and most likely played an important role in thinning stands and creating regeneration gaps and forest mosaics before fires were anthropogenically suppressed.

Windfall and avalanches are important secondary contributors to forest structure and mosaic in this area. An extreme avalanche cycle in February 1986 opened or expanded several avalanches in the forest along the east side of the San Joaquin Ridge.

Regular blasts from the Inyo and Mono Craters throughout the last 30,000 years (Wood 1977) have been steady, low-frequency disturbance events to forest, associated wildlife, and aquatic biota. Their role in initiating primary succession in blast zones may be significant in determining the course of modern vegetation and development of aquatic faunal compositions, and in influencing forest age and stand dynamics.

Land Use and Management Context

The area now included in the MJEMP has long been the subject of public interest and policy focus. Appendix 50.1 details land-use and management history of the area. Included here is a summary of historical trends relevant to evaluation of the current ecosystem management project. Use and policy trends fall roughly into five historical periods.

Pre-1950. The western portion of the MJ area was desig–nated as part of the Sierra Timber Reserve in 1890, with the remainder added in 1905. This area was transferred to the Inyo National Forest in 1908. Heavy sheep and cattle grazing dominated use of this area from the mid-1800s into the early years of national forest administration, and early records indicate that huge numbers of sheep foraged throughout the area. Although the creation of the national forest provided an opportunity to regulate grazing, it was not until the mid-1940s that numbers of animals were actually brought in line with thresholds based on range capabilities. By 1950, the Animal Unit Months had been reduced on the forest as a whole by 40%. From the standpoint of current conditions and management, however, many areas, especially the meadows and grasslands, probably still show evidence from the early days of unrestricted grazing.

In addition to bringing use of the range for grazing under control, the early orders of the national forest rangers were to extinguish wildfires. By the early 1900s, fire suppression had begun in the MJ area, although undoubtedly with variable success because of a small workforce, limited access, and simple equipment.

The first recorded timber sale on the Inyo National Forest occurred in 1908, near Mammoth Lakes, in the extreme southern end of the MJ area. The first timber-planning efforts for the national forest began about 1920, resulting in several small timber sales that supplied early construction in Mammoth Lakes and the agricultural communities of the Owens Valley. There is no indication of harvest in the area during the 1930s and only a few sales in the 1940s. All were focused in the southern end of the area, and most were overstory removal of large trees (probably Jeffrey pine), with the exception of undocumented firewood cutting.

Recreational interest has focused on the MJ area since the early 1900s with the development of resorts in the Mammoth Lakes area. The Civilian Conservation Corps (CCC) was active in the MJ area during the 1930s building roads; campgrounds at Hartley Springs, Shady Rest, and Glass Creek (still in use); trails; and ranger facilities. Early recreational uses of the MJ area were fishing, hunting, and camping.

1950–79. The Integrated Use Plan of 1950 is the earliest planning document of the Inyo National Forest to systematically outline and coordinate management objectives for the MJ area. The MJ area was in the Mammoth Zone, with all but the southern boundary coinciding with the present MJEMP boundaries. The dominant objective for the MJ area under this plan was to manage for recreation, water quality, and wildlife protection. It is important to underscore that the explicit management directions in planning documents and action of this period clearly emphasized the priority of recreation in the western portion of the area. Timber harvest was not allowed unless it was considered to have an effect on recreation and scenic values.

The area subsequently fell under the Multiple Use Plans for the Mono Lake and Mammoth Ranger Districts, both of 1970. In these plans, objectives for the MJ area continued to emphasize recreation, especially protecting the scenic beauty of the area by constraining timber harvest and other extractive uses if they affected recreation values. The plans allowed timber harvest in portions of the MJ area that were considered low in scenic and recreation value.

Shortly after the development of the Multiple Use Plans, the Inyo National Forest and Mono County signed a "community forest" agreement to produce a coordinated land-management plan for the region of Mammoth and upper Owens River. The resulting document, the Mono Plan of 1976, involved primarily private land but some national forest lands in the MJ area.

Eight timber sales, with about 60 thousand board feet (MMBF) harvested, occurred in the far north (Hartley), Deadman Creek, Dry Creek, and far southern portions of the area. Timber was not harvested, or harvested in limited quantities, in the western red fir portion of the MJ area. Continuing in the earlier pattern, harvest consisted of removing old, large, high-value trees, with most areas having only 30%–40% of the overstory removed, while a few areas had up to 70% overstory removed. Small, younger trees were left, no areas were clear-cut, and no plantations appear to have been established. Lack of clear-cuts was probably due to the fact that large trees were abundant and highly valued, rendering clearcutting unnecessary. By the late 1960s, most of the eastern half of the area (considered to have low or no recreation value) had been entered for harvest.

By 1950, grazing in the MJ area was contained in two allotments which are still used today: the June Lake and the Sherwin-Deadman allotments. Records to present indicate that total head (1,800) for each allotment remained quite stable once grazing had been regulated, whereas the permitted number of days has been sharply reduced over the years. In the 1950s, the season of use seems to have extended from early June through late October.

Recreational development with an emphasis on intensive use escalated in the eastern Sierra between 1950 and 1970, especially in the mountains and resorts surrounding the MJ area. Since the early 1900s, the area has been linked economically to southern California and especially Los Angeles (Kennedy 1995) . The resort potential of the Mammoth region was recognized and actively developed by an increasingly mobile southern California populace. The Mammoth Mountain ski area was established in 1949 and continued to expand extensively throughout the 1960s (now the largest ski area in the United States). Emphasis in the planning documents was on preparing development plans for high-class winter-sports facilities. Campgrounds were added at Pine Glen and Deadman Creek and a "vista site"added at Minaret Summit. Interpretive sites were built, including trails and a new visitor center at the edge of the area in 1969. This period saw a rapid acceleration of developed recreation along the edges of the MJ area, adjacent to the booming resort communities.

1979–88. The Land Management Plan for the Mammoth-Mono planning unit of the Inyo National Forest was developed in 1979 to meet requirements from both the Mono Plan of 1976 and the National Forest Management Act of 1976. Significantly, this was the first time the MJ area was segregated into many discrete management zones, each with different primary management objectives and permissible activities. Thus, integrity of the whole landscape was diminished from a planning perspective, coinciding with several major changes to management in the MJ area as a whole.

Whereas in the previous planning periods, timber harvest and extractive commodities had always ranked below water, recreation, and wildlife, the 1979 plan listed timber second only to watersheds in management emphasis. Language in the plan explicitly emphasized the timber value and left open for the first time much more intensive overstory removal and clear-cutting. Although public comment in response to this plan was encouraged and recorded, there were no comments on harvest, and the public apparently was more concerned about developed recreation at that time.

During this period, seven timber sales occurred, with a total of about 30 MMBF removed. For the first time, in the late 1970s, serious and comprehensive planning efforts began for major timber harvests in the mostly roadless red fir forests of the western part of the MJ area, along the base of the San Joaquin Ridge. Although there had been light harvest in some of these areas in the 1940s, the forests had retained much of their old-growth character. Plans called for major opening of this area to development, including new multipurpose roads, recreation sites, and proposed harvest of 11.5 MMBF.

Through the middle to late 1970s and early 1980s, much of this western portion of the MJ area, including the proposed timber-sale areas and lands west in the San Joaquin drainage, was included in the national Roadless Area Review and Evaluations (RARE I and RARE II). This process kept the proposed timber sales in the red fir zones on hold. In 1984, wilderness legislation allocated lands west of the MJ area into the Ansel Adams Wilderness but excluded from wilderness designation any of the roadless portions of the MJ area (called the San Joaquin roadless area). Thus, this area was considered released from mandatory roadless condition and available to be reconsidered for new management directions. For reasons considered later, however, timber plans proposed for the area were never implemented.

In addition to the major change in emphasis toward timber harvest, the 1979 Land Management Plan for the Mammoth-Mono planning unit also proposed for the first time intensive recreation development in the MJ area. By the mid-1970s, growth in Mammoth Lakes had surpassed earlier expectations. In 1971, the Inyo National forest plan reported that Mammoth Lakes was the "fastest growing community in the country." Growth and recreation demands were expected to continue to explode. The MJ area was considered a major national/international recreation destination, capable of being developed to accommodate the expanding resort population. Plans for a major trans-Sierran highway (which had first been considered in the 1950s–1960s) to complete a gap in the national interstate system were developed through the MJ area over Mammoth Pass. Attention was focused on expanding winter sports facilities (alpine skiing) in the area. Included among alternatives discussed in the 1979 plan were various ski developments that would connect existing Mammoth Mountain and June Mountain ski resorts along San Joaquin Ridge and Whitewing Mountain. This development would have affected 5,665 ha (14,000 acres) of roadless area. Although the allocation of the San Joaquin drainage to Ansel Adams Wilderness finally terminated the idea of a trans-Si–erran highway, the 1984 California Wilderness Act provision that released the San Joaquin roadless area for management reconsideration left proposals for ski area and timber harvest open.

Geothermal development issues were raised for the first time in the 1979 plan, and a Geothermal Management Zone (primarily in the southeastern portion of the area) was considered. This zone included areas suitable for leasing and further development, pending exploration and study. Geothermal development became a subject of attention during this period because of the successful establishment of the Casa Diablo Geothermal Plant at Mammoth Lakes in 1990. The USFS and Bureau of Land Management prepared an environmental assessment to determine lands (including the eastern two-thirds of the MJ area) suitable for leasing. In 1984, a lease was approved.

Independently of USFS activities, the San Joaquin Ridge was nominated as a candidate area for an inventory of National Natural Landmarks of the Sierra Nevada, commissioned by the National Park Service (Burke et al. 1982). The planned evaluation phases for landmark designation have never been undertaken by the National Park Service.

1988–93. Planning began in the mid-1980s for the Inyo National Forest Land and Resource Management Plan (LMP), and was published in 1988 (USFS 1988). The growing incompatibilities and conflicts among uses desired and proposed in the MJ area led to considerable controversy during and after the LMP planning era. The primary conflicts related to development and intensive use (alpine ski area expansion, timber harvest, geothermal development, grazing, road building) versus non-manipulative, non-intrusive uses (wilderness, wildlife habitat, old growth, biodiversity protection, water quality, Nordic skiing, and backcountry hiking).

In preparing for the LMP, a "common ground" work group including a cross-section of participants from the USFS and the public was convened to evaluate the issues and determine a concensus management objective for the MJ area. The work group found that the detailed information it needed for evaluation was not available and that desires for the area were so mutually exclusive that consensus could not be reached for the LMP. The group agreed that further analysis was needed before any significant development could take place and that such development would likely trigger the preparation of an environmental impact statement. This recommendation led to the direction in the LMP that defined the so-called Mammoth to June Study Area, which was the foundation for the current MJEMP and differed from the current area only slightly.

The 1988 LMP allocated the MJ area to seven management prescriptions, each with specific management objectives and direction (figure 50.4). The issue of geothermal development was not allocated a specific prescription, although the lease conditions were made part of the plan's overall direction. Zones were allocated for concentrated recreation use (e.g., Inyo Craters), dispersed recreation (e.g., Deadman Creek),

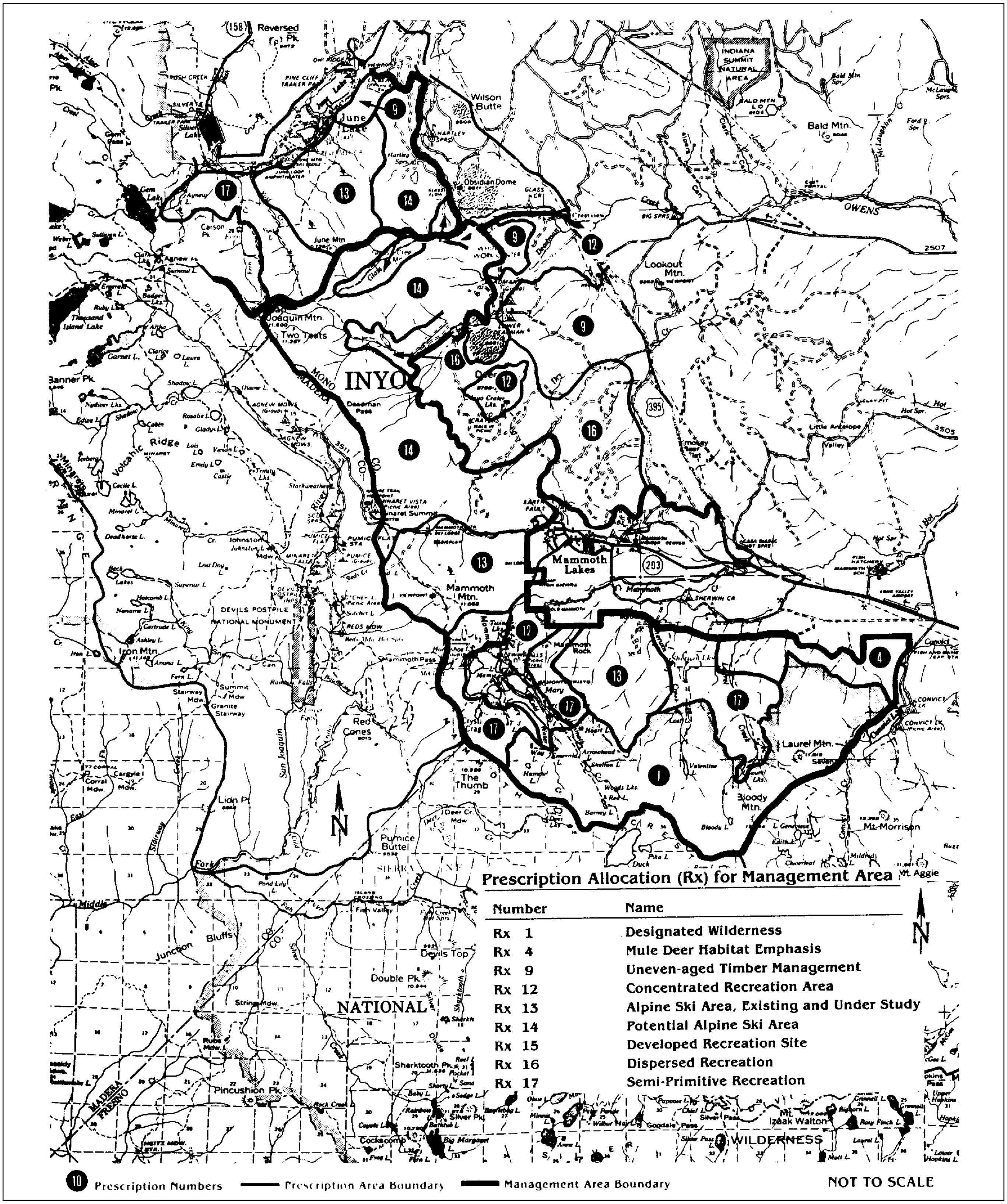


FIGURE 50.4

Management prescriptions for the Mammoth-June study area as developed in the 1988 Inyo National Forest land-management plan (USFS 1988).

semi-primitive recreation (e.g., Glass Creek Meadows), uneven-aged timber management (the eastern portion), and range. A large section along the San Joaquin Ridge, upper Glass Creek, and Hartley Springs was allocated as potential alpine ski area to maintain opportunity for such development during review of the entire area after LMP publication.

The allocation of the San Joaquin released roadless area to potential ski area remained extremely controversial. Starting in the mid-1980s, local public interest grew for primitive recreation, wildlife protection, and maintenance of roadless conditions in the red fir forest. As part of the planning for the LMP, it was determined that no timber would be harvested in the red fir belt at the base of the San Joaquin Ridge for the life of the LMP (10–15 years). Because this provision included areas in which the major red fir harvest had been proposed, those plans were finally canceled and the proposed sales terminated.

Since the mid-1980s, public interest and opposition to timber harvest and grazing management has increased dramatically. Clear-cutting, loss of old-growth trees and habitat, loss of forest diversity, and impacts of grazing have increasingly interested an active and organized environmental community. Interest in primitive, undisturbed conditions, protection of wildlife and forest habitats, and semiprimitive and primitive recreation has increased, and wilderness designation for the roadless area has been a primary goal. Countering these interests are advocates for developed recreation, primarily expanding winter sports facilities (alpine skiing) into the area.

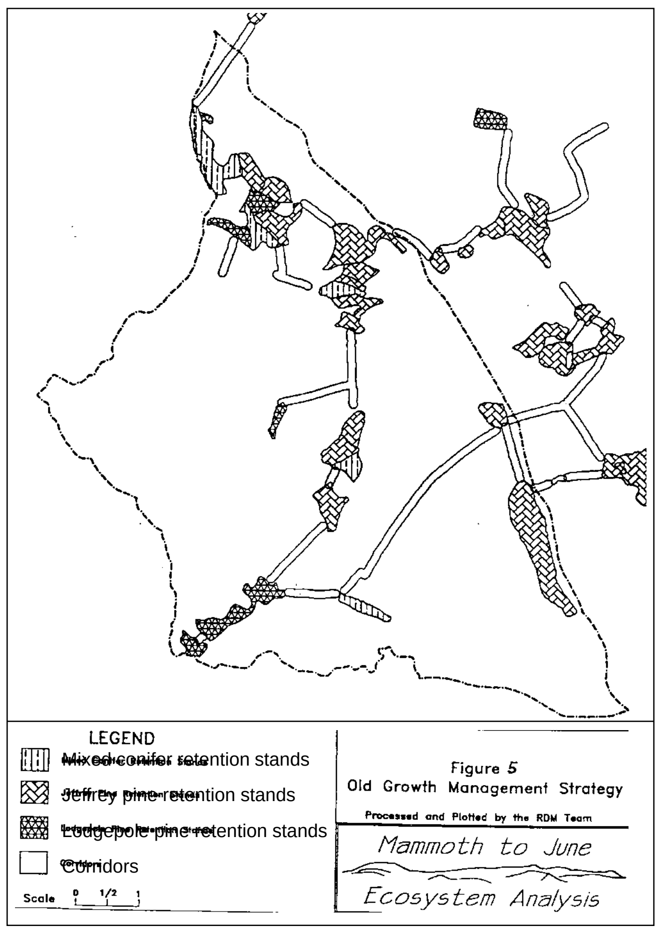
The LMP of 1988 called for retaining seral forest diversity on the timberlands of the forest. This retention was indicated in several places, both for vegetation per se and as wildlife habitat. The LMP left implementation strategy open, indicating only the seral classes (seedling through old growth) and the percentages in each class to be retained. In 1990, a group formed to develop an old-growth strategy for the Inyo National Forest. The intent of this group, which included concerned public (including local wildlife biologists), USFS biologists, and biologists from the California Department of Fish and Game, was to implement in detail the LMP seral diversity guidelines. Old-growth forests in the Jeffrey pine, lodgepole pine, and mixed conifer timber types on the forest were to be identified and mapped, and a management strategy was to be developed for enhancing, maintaining, and providing adequate acres to meet the LMP specifications.

The group met repeatedly through the next several years and mapped 2,935 ha (7,250 acres) of old-growth forest on the Inyo National Forest. A prime concern was to develop habitat in adequate amounts and configurations to support viable wildlife populations. By late 1992 a strategy had been developed and maps produced that included old-growth retention areas connected by corridors that could be moved as they became scheduled for silvicultural treatment (USFS 1992b). Old-growth recruitment areas were also identified, because inadequate acreages were available in several forest types to meet the LMP guidelines on seral diversity. Significant to the MJ area were large blocks of land included in old-growth retention areas, recruitment areas, and corridors (figure 50.5). This plan in effect removed from timber-harvest potential most of the red fir forests in the MJ area and restricted activities in many of the remaining MJ forest areas.

The Record of Decision for the Inyo LMP had stated that "additional significant development of any kind on National Forest System lands in the Mammoth/June area will require a study of culmulative effects" (USFS 1988). Thus, an interdisciplinary team of Inyo National Forest specialists was appointed to begin an analysis and an environmental impact statement (EIS) for future management of the MJ area. The EIS and subsequent Record of Decision were intended to "select an alternative that will identify an integrated set of actions that will be implemented in the Mammoth to June area" (USFS 1988). The MJ Study Group began in October 1990, and some resource inventories and studies were initiated soon thereafter. In September 1992, leadership changed, and the group reconvened as the Mammoth to June Integrated Resource Analysis (IRA), which was to be a pilot project under the newly adopted ecosystem management. Although the

FIGURE 50.5

Old-growth management strategy.



team met several times, other forest priorities stalled progress, and the IRA never crystallized.

Also in 1992 the Research Natural Areas Program of the USFS Pacific Southwest Research Station and Region proposed a research natural area (RNA) in middle of the MJ area (USFS 1992c). This proposal targeted Whitewing Mountain because of the unusual presence of an ancient downed forest on its summit (figure 50.6). The logs appear to have been blown down by blasts from one of the nearby Inyo Craters 530–650 years ago (radiometry on the downed logs coincides with the blast date). The downed trees remained intact for six centuries on the high summit of this peak because of the arid environment. They are valued by the research community for their age and their role in understanding vegetation response to climate change. Several of the logs have been identified as species that no longer live in the eastern Sierra (e.g., sugar pine Pinus lambertiana) or as local species that grow in ecologically very different sites today (Millar 1995) . The growth and form of these logs are different from those of the vegetation on this arid and barren summit today, and their presence indicates the conditions that led to the dramatic vegetation change that occurred. Research on these logs continues. In 1993 the Inyo Forest Supervisor requested of the Regional RNA Committee that a decision on the designation or rejection of the proposed Whitewing RNA be delayed pending analysis of the entire MJ area. In the meantime, the area is managed for protection of scientific values.

Extended drought through the late 1980s and early 1990s and the occurrence of several local and/or large fires within and closely adjacent to the MJ area (Laurel Fire 1987, Mammoth Fire 1987, Rainbow Fire 1992, and Bald Mountain Fire 1993) increased the fear of catastrophic fire in the eastern Sierra. The community of Mammoth Lakes in particular has grown increasingly concerned that actions be taken by the USFS to reduce risks of catastrophic fires starting in the wildlands and burning into town (Kennedy 1995). In November 1993, the Inyo National Forest proposed a fuel reduction project in the MJ area, which would have included salvage timber harvest and prescribed fires of 2,670 ha (6,600 acres) of the MJ area. Red fir and mixed conifer forests within the released roadless area were included in this proposal. The local environmental community reacted angrily against this or any ground-disturbing activities in the released roadless area before completion of the Mammoth-June cumulative effects study. In February 1994, the Inyo National Forest rescinded the proposal for salvage or prescribed burning in the released roadless area pending completion of the MJ study but retained plans for fuel reduction in the zones with roads near Mammoth Lakes.

1993–Present. In January 1993, Inyo National Forest line officers and staff were trained in the national forest plan implementation (USFS 1992b), one of the first forests in the Pacific Southwest region in which this training was done. In February 1994, the Draft Region 5 Ecosystem Management Guidebook was issued (USFS 1994). Because staff on the Inyo National Forest had been involved in both teaching others about the forest plan implementation and developing the regional ecosystem management guidebook, they had a high degree of knowledge about the underlying concepts and the intent of the guidelines as well as the motivation to apply them.

FIGURE 50.6

Ancient downed logs on Whitewing Mountain, blown down 530–650 years ago by a blast from the nearby Inyo Crater, are included in the proposed Whitewing Research Natural Area that would be maintained for the study of vegetation response to climate change.

With the release of the draft regional ecosystem management guidelines in February 1994 the Mammoth-June IRA evolved into the Mammoth-June Ecosystem Management Project. The intent was to follow the new guidelines for landscape analysis rather than proceed with the EIS process. At the same time, the project was adopted as a case study of ecosystem management by the Sierra Nevada Ecosystem Project.

One reason that the MJ Integrated Resource Analysis effort did not get under way was its low priority among other Inyo National Forest projects. In 1994 the priority of the MJEMP rose and has remained a relatively high priority since. In addition to the LMP imperative, two situations prompted this recent urgency. One was the fire hazard issue. Environmentalist reaction notwithstanding, the communities of Mammoth Lakes and June Lake remained concerned about the risk of fire burning through the MJ area and insistent that the Forest Service reduce the hazard. An evaluation of environmental conditions at MJ had to be done before measures could be taken to address these fuel situations adequately.

Another pressing issue was geothermal leasing. Renewed interest has been expressed in developing the geothermal leases near the Dry Creek Basin, originally explored by Unocal. The 1981 lease gave contract opportunities to the lessee throughout the entire southeastern half of the MJ area. The so-called diligence requirements meant that the lessee must take exploration actions to maintain the lease. Exploration does not imply development of geothermal power sources, but it does entail action on the part of the lessee, public involvement, and, potentially, environmental analysis. If geothermal development were to proceed, a power plant similar to that at Casa Diablo might be built in the MJ area. It was appropriate to conduct the MJ landscape analysis before any project-specific actions such as this were taken, but lease requirements imposed deadlines to this preference.

Furthermore, a major water development project was proposed for the MJ area. The Mammoth County Water District has sought a special-use permit from the Inyo National Forest for four ground-water wells and a pipeline along Dry Creek to augment its other water supplies for the town of Mammoth Lakes, especially in dry years. Exploratory wells drilled and tested in 1988–1990 demonstrated the feasibility of a large-scale pumping project. Annual production could be as high as 2.4 million m^3 (2,000 acre-feet). Concern exists that ground-water pumping could alter the discharge of Big Springs, to which the Dry Creek Basin is assumed to contribute water. However, the proposed maximum volume to be extracted is less than 15% of the estimated annual recharge within the upper basin and less than 1% of the annual flow of Big Springs. The California Department of Fish and Game is also concerned about the impact of pumping on Mammoth Creek and the Hot Creek Fish Hatchery.

Summary of Management History

From this brief history, it is evident that the MJ area has been the focus of land-management attention for decades. The groups most actively involved have been the land administrators (USFS), the traditional local public (longtime resident communities), the "resort public" (Mammoth Lakes and connected urban communities of southern California), local scientists, and the new local public (recent in-migrants, who may have different values and interests). Over time the international reputation of Mammoth Mountain Ski Resort and an increasingly sophisticated environmental community brought the values and controversies of the MJ area to the attention of nonresident and distant populaces. Complex interactions between national and local policy, societal trends, and incidental local situations over the years resulted in the patterns of land management summarized earlier.

The history of land use and public interest in the MJ area shows repeating cycles over time. Since the early 1900s, prevailing attitudes about the MJ area fluctuated between pro-development and pro-protection (or manipulative versus non-manipulative uses). After the earliest days when grazing was rampant and timber harvest—though low-level—was unrestricted, the first swing toward strong protection of recreation and scenic values began in the 1930s. A long period followed when grazing was brought into regulation, and harvest was low priority, allowed only if it benefited recreational values. The dominant value during this time was based on primitive camping, fishing, and hunting. As the southern California population became more affluent and mobile, and as resort development in Mammoth Lakes grew, so did the interest in development of the adjacent MJ area. This interest triggered a swing toward aggressive development. By the 1960s, alpine ski areas were being proposed in the MJ area, roads were built and paved, a trans-Sierran highway was designed, and much more active and extensive timber programs were planned and conducted. Subsequently, a strong environmental faction once again opposed the pro-development designs, which nevertheless have remained to the present. The environmental group favored protection not just for scenic and recreational opportunities, but also for undisturbed wilderness and inherent ecological values.

Some of these cycles seem to mirror national trends in land management, as reflected first in the early "presence" era of the USFS, and the early fire-suppression and CCC recreation decades. Increasing affluence brought urban travelers interested in rugged outdoor scenery and intensive outdoor play and provided money to develop mountain areas for these ends. The spirit of the Multiple Use Act of 1960 was reflected locally in the MJ area at that time. Backlash to this intensive development period was felt in the eastern Sierra and in attitudes toward the MJ area, as the environmental laws of the 1970s (especially those that greatly affected the USFS, such as NEPA and NFMA) became widely used and advocated by environmentalists. The swing toward ecosystem management in the early 1990s has been perceived by the pro-protection public as yet another turn back toward human intervention in the MJ area, because the focus on sustainable ecosystem conditions—in ways that seem paradoxical at first—appears to favor manipulative or interventionist actions to restore natural processes and structures. This reaction appears in part related to overall distrust of the USFS as an agency, resulting from past actions in local and nonlocal contexts.

Concomitant with the cycles in types of management emphases have been cycles in the way the MJ area has been geographically zoned in management units. During the early agency days and the primitive recreation period, the MJ area was considered primarily a single management unit. During the more intensive development era, the area became increasingly fragmented into several distinct management units, each under different jurisdictions and with different management objectives. The highest degree of fragmentation occurred in the LMP of 1988, when the area was divided into seven management prescriptions, each with different management objectives. The ecosystem management era brought a return in focus to the MJ landscape as a single holistic unit for cumulative planning and management. The periods of protection (for either recreation or ecosystems) favored management of the area with the least fragmentation.

Linkages of the MJ area and adjacent areas to various human communities have influenced the prevailing attitudes toward management and land use. Since the early 1900s, the relatively rare presence in the eastern Sierra of ready access to extensive forests and lush meadows with relatively gentle topography attracted local and distant recreationists to the MJ area. The increasing links between southern California and Mammoth Lakes have tended to bring urban money tinged with development and intensive recreation interests. By contrast, the links of Mono Lake activists to environmental communities in northern and southern California (and elsewhere) have provided educated resident and distant populations concerned about and well-versed in environmental protection. An increasingly active local community of environmental scientists, who bring urban-educated values and insights, has focused on the MJ area's important physical and biological resources. Local communities have favored maintenance of traditional dispersed recreation (hunting, fishing, woodcutting, off-road vehicles) as well as activities that bring economic prosperity to the small towns (skiing, hiking, nature study).

Question 2. What Specific Ecosystem Management Methods, Approaches, or Policies Are Being Applied in the Mammoth-June Ecosystem Management Project?

Intended Goals and Process

The ultimate goal of the MJEMP was to resolve the issue of resource thresholds for the Mammoth-June area left unresolved by the 1988 Land Management Plan. Since the MJ IRA had lapsed, a new team (though with many of the same players) was composed for the MJEMP in early 1994. This reconstituted team met for the first time in April 1994. Represented on the team are the following resource specialties (all Inyo National Forest staff): team leader (forest ecosystem management coordinator; recreation / fire), geology, soils, air quality, insects and disease, fisheries, range, recreation, vegetation ecology, wildlife biology, fire and fuels, hydrology, landscape architecture / visual-quality management, archaeology / historical ecology, and land-management planning (appendix 50.2). Specialists from both the forest level and the two ranger districts that the MJ area spans are involved. About fifteen staff members have primary responsibilities to conduct analyses, while many more attend meetings and participate in technical aspects.

Whereas the previous MJ IRA, like all environmental analyses, had focused on identifying issues and developing alternative projects to resolve conflicts, the intended goals for the MJEMP were much different. Following the guidelines of forest plan implementation (USFS 1992a) and the draft Regional Ecosystem Management Guidelines (USFS 1994), the goals of the MJEMP were to develop a desired condition for the landscape (management objectives) and generate potential management practices that would allow the desired condition to be achieved over time. The desired condition was to be consistent with the LMP as much as possible, within its inherent flexibilities. Analysis would be based on physical and ecological capabilities, thresholds, and health conditions of the landscape; social goals and public conflicts would be incorporated subsequently into a final desired condition. The process identified at the first meeting involved the following seven intended or planned steps:

1. Define the Analysis Area. The team considered five alternatives for adjusting the boundary that had been used in previous planning efforts. These ranged from expanding the boundary to include entire watersheds (uppermost Dry Creek had been excluded previously because of the presence of Mammoth Mountain Ski Area and other developments) or expanding to include the adjacent communities of Mammoth Lakes and June Lake. The final decision was to keep the original (LMP) boundaries (figure 50.4) even though they do not adhere to current ecosystem management guidelines to avoid fragmenting watersheds. The existing boundaries focus on potential land-use issues and constrain further development until the analysis is complete. The team decided to retain the original boundaries but allow boundaries to be fluid for the purposes of data collection and responsiveness to issues relevant in individual analyses. Thus, data could be collected outside the area, and adjacent landscapes would be brought into analysis, but the intent of determining a desired condition for the MJ area would be as defined in the LMP.

2. Describe the Existing Condition. Much attention was given to approaches for describing current conditions in the MJ area. Ecological indicators (later called environmental indicators) were chosen as a basis for evaluating ecosystem health and sustainability. Specific indicators were chosen that represented, in the team's view, the key compositional, structural, and process elements in the MJ landscape. The ecological indicators would be used initially to focus analysis of existing conditions and subsequently to describe measures of desired condition. Thirty-nine ecological indicators in seven categories were tentatively chosen and assigned to team members for analysis (table 50.2).

The team chose ecological indicators that could be measured and managed practically. Thus, although avalanches, earthquakes, volcanic eruptions, contemporary weather and climate change potentially greatly affect natural dynamics in the MJ area, the team decided to study these for their influence on the ecosystem but not to include them as practical descriptors of desired condition.

Social indicators for existing and historic conditions were not developed initially. The team hoped to have assistance in developing creative approaches to social analysis, but when this did not occur, the team settled on using traditional visual-opportunity-spectrum ratings and visitor recreation measures as indicators for assessing and developing a desired condition.

3. Describe the Historic Condition. The team agreed that although the ability to successfully infer and describe historic condition varies by ecological indicator, the value of historic understanding in analysis made the effort to obtain historic information worthwhile. The team chose to understand historical information not for creating a desired condition that mimicked the past, but rather, for assessing viabilities and health of current conditions and making recommendations about (not targets for) future management. The team accepted that each ecological element would require a slightly different approach to historical analysis, some quantitative, some qualitative, some entirely inferential and even anecdotal or speculative. The group further acknowledged that the relevant time depth for understanding historic ranges of conditions varied with the attribute, because of both scientific and practical considerations. The most appropriate time period for

TABLE 50.2

Ecological indicators initially chosen to describe existing and desired conditions in the Mammoth-June Ecosystem Management Project.

Key Resource Area	Ecological Indicator	Unit of Measure
Air quality	Visibility	Miles
	PM-10	Microgram/m^3
	Ozone	ppm
Watershed	Stream-flow duration	cfs
	Stream-flow timing	cfs
	Stream-flow magnitude	cfs
	Springs	Number of springs
	Channel stability	Channel stability ratings
	Soil erosion	Tons/acre
	Soil productivity	
	Water quality	Temperature Degrees F/C
	Turbidity	jtu
	Conductivity	mv
	pH	pH
	Total suspended solids	mg/l
	Total dissolved solids	ppm
Biodiversity	Key species habitat available	Acres
	Key species habitat distribution	
	Key species population	Number of individuals/pairs
	Key species distribution	
	Vegetation composition	Acres
	Vegetation structure	Seral stage/strata
Fisheries	Pool habitat	Number of pools/mile
	Biomass	Pounds/acre
	Woody debris	Number of pieces/mile
	Species distribution	
	Trophic status	
	Macroinvertebrates	
Fire	Size	Acres
	Intensity	Flame length, btu ft^2
	Frequency	Recurrence interval
	Distribution	
	Fuel loading	Tons/acre
	Fuel model	NFFL fuel-model type
	Fuel structure	
Insects/pathogens	Severity of epidemics	Percentage mortality
	Size	Acres
	Distribution	
	Species affected	

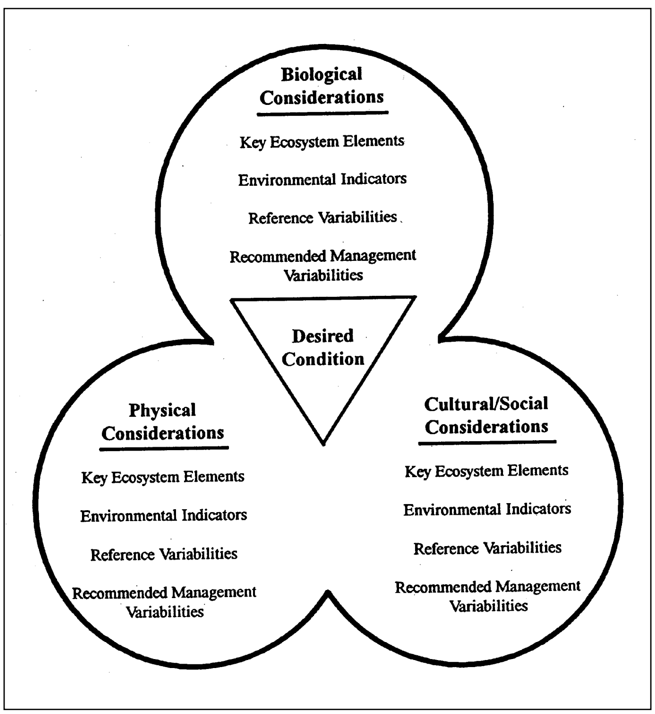
analysis would be one that was responsive to the temporal sensitivity of the resource and that embraced basically modern conditions. For understanding many attributes, several hundred to several thousand years was considered an appropriate theoretical length of time. Practically, information was available for most attributes only for far shorter time periods.

4. Describe the Desired Condition. In USFS terms, echoed by the MJEMP, desired conditions are an expression first of future land conditions that are within bounds of ecosystem sustainability. The analyses of environmental conditions and descriptions of existing and historic conditions and variabilities would provide a background for assessing the condition of the present environment relative to a sustainable one. Conditions determined to be unsustainable, artificial, unnaturally unstable, anthropogenically vulnerable, or significantly outside natural ranges of variabilities would be identified. These factors would lead to conceptualization of desired environmental conditions that would be within a window of ecological sustainability.

Desired condition is not recognized by the USFS nationally or regionally, however, as a statement solely of ecological sustainability. Ecological analysis forms the first part of the process, followed by incorporation of socially desired goals and conditions for the landscape (figure 50.7). When these are incorporated with ecological goals (with various potentials for conflict among goals), desired conditions are determined. Thus arriving at a final desired condition itself takes several steps. The team agreed that the desired condition for the MJ landscape was an integrative statement of the future of the MJ landscape, resulting from ecological analysis and integrating public input and analysis of socially desirable conditions.

FIGURE 50.7

The Pacific Southwest Region approach used in MJEMP of integrating biological, physical, and cultural/social considerations to arrive at a desired condition for a landscape (Manley et al. 1995).



The team recognized the following locations and issues to have high public interest. Although the desired condition would not indicate management categories or land designations, the following public interest issues would be considered in development of the final desired condition in the MJ area:

- Alpine versus Nordic skiing
- Deer migration/fawning areas
- Geothermal leasing
- Glass Creek Meadows
- Managed fires
- Marten/goshawk habitat
- Mortality/fuels/fire hazards
- Old-growth forests
- Potential wilderness
- Proposed research natural area
- Recreation: dispersed versus developed
- Red fir forest
- Released roadless area
- Timber harvest
- Trout recovery
- Water development

5. Identify Opportunities. Following both the forest plan implementation and draft regional guidelines, the MJEMP team intended to compare existing condition to the desired condition as a starting point for recommending various strategies by which the USFS could potentially bring about the desired conditions.

6. Identify Management Practices. Once the opportunities for action are identified, specific management activities and practices would be proposed that would steer the MJ landscape toward the desired future. Alternative management practices and strategies, compatible with ecological and social constraints determined in earlier steps, would be identified.

7. Select, Schedule, and Prioritize Practices. Scheduling management projects for NEPA analysis was the final step identified for the MJEMP. The team acknowledged that the work would not end there but would become part of the analysis, documentation, decision, and monitoring feedback loop for adaptive management. The MJEMP asserts that its final step ends before any NEPA analysis begins. Thus it attempts to stay in a non-decision-making phase of the forest plan implementation process (figure 50.1) (USFS 1992a) .

From a planning perspective, the MJEMP process was viewed as partial LMP implementation. The LMP's formal management prescriptions were binding during the analysis period. However, some of the management directions in the LMP are forestwide, ambiguously described, and geographically unfocused. Thus they do not integrate individual ecosystems (landscapes, watersheds) into functional wholes but view resources piecemeal over the landscape. The MJEMP was intended to focus the LMP's general direction on the specific needs of the MJ landscape and to consider cumulative effects of potential projects on the landscape. The ecological and physical analyses, however, were to be "blind" to LMP prescriptions, focusing primarily on landscape capabilities. If the landscape analysis brought to light information and conclusions that indicated the LMP to be in error, or if the refined desired conditions significantly deviated from the LMP, then a LMP amendment would be implicated.

Public participation in the MJEMP was intended to occur in several ways. Informally, each team member was responsible for collecting and using research information from specialists who work in the MJ area or have expertise pertinent to the analyses. For the MJ area, there is considerable published work on some aspects of the landscape and a moderate amount of informal research, research interest, and local scientific focus.

More general public participation was planned for formal meetings in which information would be shared during the course of steps 1 through 3. At the time the desired condition was being developed, more active public participation was planned, with iterative meetings to identify conflicts, propose modifications, and develop an integrated desired condition. A consensus process was not intended, although input and evaluation was encouraged.

Initially the MJEMP team considered a formal collaboration with the Coalition for Unified Recreation of the Eastern Sierra (CURES) to provide iterative public feedback for developing the desired condition. Although CURES members represent diverse backgrounds, their focus on recreation meant that they would not adequately represent all public sectors likely to be interested in the management of the MJ area. Thus the team decided to use open public meetings to share information and get public feedback.

The timetable for completion of the work was initially two years for steps 1 through 5, at which point a report would be written and NEPA analyses could begin if implicated.

Data from analysis of both existing and historic conditions would be entered into a geographic information system (GIS) wherever possible. At the beginning of the MJEMP, there was no existing GIS for the forest, and team members took responsibility for developing a system that used preexisting electronic information and could provide the capacity for analyses needed during the MJEMP. Data not appropriately handled by GIS would be maintained in tabular or narrative form.

Funding for the MJEMP was on an ad hoc basis. Individual Inyo National Forest resource departments would pay from their budgets, a situation that became defensible only when the MJEMP was identified as high priority in forest planning for 1994 and 1995. Available funding played a role in determining the level of analysis of the ecological indicators and the nature of the analyses included.

Actual Goals, Process, and Progress

Between February 1994 and September 1995, the full MJEMP team held many office meetings and two field sessions. Subgroups (e.g., vegetation working group) met more often. These meetings were all working meetings of the MJEMP team, and the public was not specifically invited. Four public meetings and a field trip focused specifically on the MJEMP. The actual goals, process, and progress of the MJEMP through October 1995 are described under each of the seven steps intended to guide the process.

1. Define the Analysis Area. As indicated earlier, five alternative boundaries were discussed by the team, with those from the original LMP chosen for the MJEMP (figure 50.4). The reorganization of the Inyo National Forest (discussed under Question 3 later in this chapter), which took place at approximately the same time as the MJEMP (1994–1995), realigned management areas on the Forest into eight key landscapes (figure 50.8). The MJEMP is entirely contained within the upper Owens Watershed and coincides with that landscape on all but the eastern edge. Thus, because management philosophy has changed drastically throughout the forest as a result of reorganization, the designation of these landscape boundaries might have affected the MJEMP had the boundaries of the project not been accepted as forest landscape boundaries. As it is, reorganization strengthened the focus of the MJEMP.

Concern over the exclusion of the Dry Creek headwaters from the MJEMP persisted by those who criticized watershed fragmentation. Conversely, representatives for the special-use permit (Mammoth Mountain Ski Resort), which covers this area, voiced support for the exclusion of these lands. In fact, the flexible approach to boundaries that the team adopted resolved this issue. Actual analyses of interest (water and stream flows) were in fact conducted in the headwaters subbasin and used in understanding existing and desired conditions in the rest of the drainage.

2. Describe the Existing Condition, and 3. Describe the Historical Condition. By far the greatest efforts of the team have focused on these steps. Tables 50.3–50.5 summarize the nature of information collected or in process of being collected to address the objectives of describing existing and historic conditions. Most of the analyses are complete and have been summarized in a preliminary report (USFS 1995b). Much of the information on existing condition is quantitative and spatial, and has been entered into the Inyo National Forest geographic information system (USFS 1995c) (table 50.5).

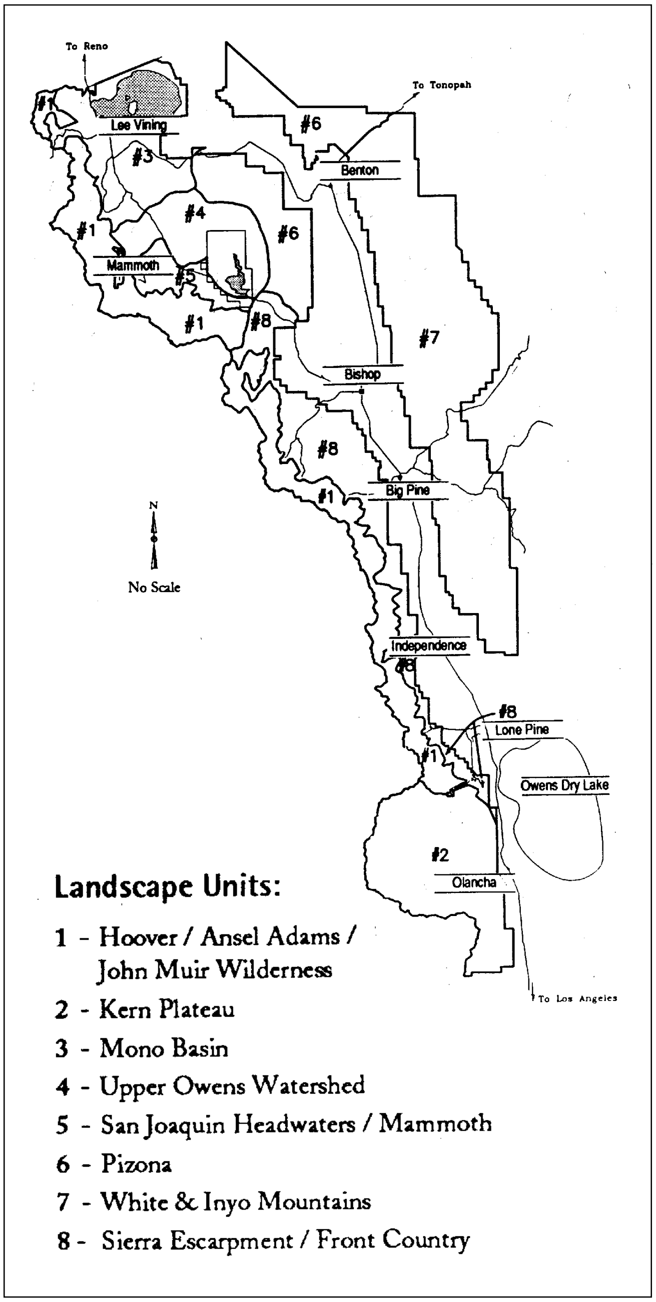


FIGURE 50.8

Inyo National Forest landscapes resulting from the forest reorganization of 1994–95. The MJEMP is fully contained in the Owens Watershed (landscape 4), and its boundaries coincide with that planning unit on all but the eastern edge (USFS 1995a).

Coverage, intensity, and validity of data vary by indicator. Some features have been described over the entire area, others logically included only parts of the area (e.g., aquatic conditions), and others were geographically limited by time and available funds. Depth of coverage and intensity of analyses were determined by the importance of the ecological indicators and practical factors. Because they were considered critical elements, emphasis was given to forest vegetation structure and composition and to water. Key questions considered and use of data in the analyses are summarized by ecosystem elements as follows (further detail in tables 50.3–50.5, appendix 50.2, and USFS 1995b).

Water. Key questions address the nature and abundance of water flow, streams and springs, and annual / seasonal fluctuations, the impact of human activities on water quality, and the effects of diversions on stream flow. Significant natural variations have been documented for only five years. Overall, the watersheds in the MJ area, regionally very important as the headwaters of the Owens River, are in good condition. Impacts are localized, and water quality is excellent. Many springs in the area provide important scattered wetland habitat.

Vegetation structure and composition. Maps of dominant / codominant vegetation based on several sources have been compiled in the forest GIS. Because information about forest structure and composition was considered one of the most important indicators, considerable fieldwork was done to complete inventories on overstory and understory vegetation. Field mapping and polygon verification of dominant vegetation have been completed for about one-third of the forested MJ area. This mapping was augmented by information from the USFS ecology program work on red fir classification (Potter 1994) . A floristic study is partially completed for much of the area outside the meadows (Constantine 1994). Based on results from fieldwork and previous data, models of species replacement with elevation and slope are being developed. The model will be used to extrapolate vegetation inventory to unsurveyed parts of the landscape.

Fire / fuels. Primary questions are, What are the existing fuel loads, stocking levels, current and historic fire intervals (spatial and temporal ranges)? What did the area look like before fire exclusion? Sampling for fuels has focused in the pine and mixed-conifer timber areas. Fire-history analyses have been done for much of the area, but sampling has been low. History studies from fire scars go back only to the 1700s; charcoal analyses from pollen cores in Glass Creek Meadows will extend these fire data when the study is complete.

Analyses indicate highly variable pre-suppression fire intervals in pine and mixed conifer types, with an average of 10–20 years, and longer in red fir (up to 30 years or more). Fires appear to have been low intensity in both pine and fir types, although stand structure in the fir types suggests that stand-replacing events occurred during certain past climatic periods. No evidence exists, however, for large fires in the fir forest in recent times. Sampling suggests high variability in the site and inten-

TABLE 50.3

Ecological indicators included in analyses of existing and desired conditions in the Mammoth-June Ecosystem Management Project compared to intended indicators.

Key Resource Area	Intended Ecological Indicator	Intended Unit of Measure	Existing Conditions[a]	Historic Conditions
Air Quality	Visibility	Miles	Ql	Ql
	PM-10	Microgram/m^3	Qn	Ql
	Ozone	ppm	Qn	Ql
Watershed	Stream-flow duration	cfs	Qn	Ql[b]
	Stream-flow timing	cfs	Qn	Ql
	Stream-flow magnitude	cfs	Qn	Ql
	Springs	Number of springs	Qn	Ql
	Channel stability	Channel stability ratings	Qn	Ql
	Stream crossings[c]	Number crossings/km	Qn	
	Soil erosion	Tons/acre	Qn	—
	Soil productivity	Qn	—	
	Snowpack water content	Qn	—	
Water Quality	Temperature	Degrees F/C	Qn	Ql
	Turbidity	jtu		
	Conductivity	mv	Qn	—
	pH	pH	Qn	Ql
	Total suspended solids	mg/l	—	—
	Total dissolved solids	ppm	—	—
Biodiversity				
Vertebrate	Key species habitat available	Acres		
	Spotted owl		Qn	Ql
	Goshawk		Qn	Ql
	Willow flycatcher		Qn	Ql
	Breeding birds		Ql	—
	Marten		Qn	Ql
	Mule deer		Qn	Ql
Vertebrate	key species habitat distribution for species listed above		Qn	Ql
	Key species population sizes	Number individuals/pairs	Qn	—
	Key species distribution		Qn	—
Amphibians	**Habitat availability**	Acres	Qn	Ql
	Habitat distribution		Qn	Ql
	Metapopulation structure	Population size and number	Qn	Ql
Plant	Vegetation composition (species mix, veg types)	Acres	Qn	Ql/Qn
	Forest structure	Seral stage/strata	Qn	Ql
		Density	Qn	Ql
		Range of age/size classes	Qn	Ql
		Susceptibility to disturbance	Qn	
	Down woody debris	Tons/acre	Qn	Ql
	Cover of: total vegetation, duff, litter, bare ground	Percentage basal cover	Qn	Ql
Fisheries	Pool habitat	Number pools/100 m	Qn	Ql
	Biomass	kg/ha	Qn	Ql
	Woody debris	Number of pieces/km	Qn	Ql
	Species distribution (trout)		Qn	Ql
	Trophic status		—	—
	Macroinvertebrates	Species composition	Ql	—
	Pool sedimentation	Percentage coverage of pool	Qn	—
	Cobble condition	Percentage embeddedness	Qn	—
Fire	Size	Acres	Qn	Ql
	Intensity	Flame length/btu ft^2	Qn	Qn
	Frequency	Recurrence interval	Qn	Qn
	Distribution		Qn	Qn
	Fuel loading	Tons/acre	Qn	Ql
	Fuel model	NFFL fuel-model type	Qn	Ql
	Fuel structure		Qn	Ql
	Cause of fire	Human, lightning, etc.	Qn	Ql
	Vegetation type	Percentage of fire in type, species, age of trees	Qn	Ql
	Fire risk	Percentage of fire type	Qn	
Insects/Pathogens	Severity of epidemics	Percentage mortality	Qn	—
	Size	Acres	Qn	—
	Distribution		Qn	—
	Species affected		Qn	—
Human Use	Prehistoric culture	Number of sites	Qn	
Recreation	**Recreation facilities**	Number facilities	Qn	Qn
	Recreation use levels	Recreation visitor days	Qn	Ql
	Visual quality	ROS/VQO ratings	Qn	Ql
		Acres in seen area	Qn	—
	Sensitivity levels	Ratings	Qn	—
	Variety class	Ratings	Qn	—
	Visual absorption capability	Ratings	Qn	—

[a]Ql indicates qualitative information; Qn indicates quanititative information.
[b]Historic conditions inferred only for Glass Creek watershed.
[c]Bold indicates a new indicator or unit of measure beyond those initially intended.

TABLE 50.4

Additional information available or being collected by the MJEMP team for use in analysis of existing and historic conditions and for development of desired condition.

Ecosystem Element[a]	Information Available or Being Collected[b]
Geology	Bedrock geology (Qn)
	Seismic, volcanic, landslide hazards (Qn)
	Fault locations (Qn)
	Geothermal areas (Qn)
	Glacial conditions (existing/historic) (Qn)
	Topography
	Stream locations
Climate	Climate regimes (existing/historic) (Qn/Ql)
	Fire weather (current) (Qn)

[a]These elements are not considered environmental indicators in analysis.
[b]Qn indicates quantitative information; Ql indicates qualitative information.

sity of fires within the MJ area. Evidence confirms a change in fire pattern (size, frequency, distribution) concomitant with suppression era. Fire suppression has considerably changed forest structure and composition, primarily in the pine types. Sampling is adequate to reach tentative and generalized conclusions about the natural fire regimes in the vegetation types within the MJ area.

Wildlife. For critical vertebrates, direct studies are assessing presence, population size, and habitat-use parameters. Determining the value of the MJ area to wildlife is especially critical because of its proximity to transmontane migration corridors. East-side habitat may be used in ways very different from habitat on the west side, where most knowledge about vertebrates derives, and habitat requirements and population viabilities may be unique. Critical species include spotted owls (first confirmed sightings reported recently on the Inyo National Forest in red fir forests; the question of interest is the extent of easterly ecotone along the San Joaquin Ridge), marten and other furbearers, goshawks, willow flycatchers, and breeding birds. The red fir forests, meadows, and riparian zones are the focus of wildlife study in both disturbed and undisturbed areas throughout the MJ area.

Insects / pathogens. Key questions are, What is the temporal and spatial pattern of mortality caused by insects and pathogens in different vegetation types? What is the nature of disturbance from insects and pathogens under normal fire regimes? To what extent has fire suppression or drought created conditions of abnormal insect and pathogen epidemic? Mortality in the MJ forests is considerably higher than background levels for the pine type, and is attributed to drought, fire suppression, and silvicultural activities.

Fish / aquatic biodiversity. Key questions pertain to the composition of fish and amphibian fauna, conditions of the stream habitat, viability of fish and amphibian populations relative to known healthy or undisturbed populations, and extent to which human activities have affected habitats and populations of the aquatic fauna. Comparisons are being made of habitat characteristics in reaches above and below disturbed areas in an attempt to assess health of populations in disturbed streams. Surveys are being conducted on springs and streams in the MJ area for fish and amphibians. Intensive surveys have been done for Yosemite toad, mountain yellow-legged frog (Rana muscosa), and exotic naturalized Lahontan trout. For remaining species, inventories have focused on available habitat. The fish biologist is working closely with the hydrologist to develop an understanding about the relationship of water quality and stream / spring flows to species' requirements and to evaluate the history of fish planting and management. Glass Creek is dramatic in its large population of trout, highly productive for other aquatic species, and unusual in low amounts of woody debris, all of which appear to be natural conditions. Effects of fish on frog populations are being investigated.

TABLE 50.5

Data layers in the Inyo National Forest geographic information system developed by the MJEMP team and other available sources for analyses of existing and desired conditions in the Mammoth-June landscape.

Administered Lands
Administrative Withdrawn Lands
Air Pollution Control Districts
Air Quality Non-Attainment Areas
Archaeology Sites
Bald Eagle Habitat
California Airshed Class Designation
County Boundaries
Fire History
Forest Plan Management Areas
Forest Plan Prescriptions
Forest Service Unit Boundaries
Geothermal Lease Boundaries
Goshawk Habitat
Inyo Plantations
Lakes
Land Ownership Data
Local Government Boundaries
Mammoth to June Updated Vegetation
Management Areas
Old-Growth Management Strategy (Areas)
Old-Growth Management Strategy (Corridors)
Outside Boundary of Administered Lands
Proposed Wild and Scenic Areas
Public Land Survey
Roadless Area Review and Evaluation
Soil
Springs
Stream-Flow
Streams
Trails
Unsuitable Lands
Vegetation from Landsat
Visual Quality Inventory
Visual Quality Objectives
Watershed Designation (CalWater)
Wild and Scenic River Study Areas
Wild and Scenic RiverAreas
Wilderness Areas

Historical ecology. Key questions focus on reconstructing late Holocene forests, and from this developing an un–derstanding of the pattern of vegetation dynamics through time, describing trends and periodicities in vegetation composition, rates of change, successional pathways, variation in disturbance regimes, and the nature and rate of response of vegetation to climate change. Studies include floristic and climate analysis over several thousand years as documented in pollen cores from Glass Creek Meadows and analysis of ancient downed woods atop Whitewing Mountain.

Archaeological studies are addressing the patterns and trends of human land use since the initial occupation; the history of human adaptation in terms of settlement, technologies, and resource bases; the response of human populations to environmental variation; and, conversely, the nature and extent to which human populations have affected the environment.

Together, these analyses focus directly on the historic condition of the landscape, especially on the dynamics of climate and physical changes as they relate to biotic responses.

Geology. Questions asked and data collected provide important background information on the physical landscape. These data in turn provide a baseline for analyzing impacts from and imposing constraints on future uses in the MJ area. This information will be especially important for evaluating anticipated geothermal proposals.

Recreation/visual resources. Potentials in the MJ area have been developed by surveying its visual quality, condition, sensitivity, and absorption capability. Inventory maps exist for visual data, showing Visual Quality Opportunity (VQO) classes, seen areas, sensitivity classes, and existing visual conditions. From a recreational standpoint, the presence of major montane forests—the most extensive, accessible forests of their kind on the eastern slope of the Sierra Nevada between Los Angeles and Lake Tahoe—is of prime importance. The combination of old-growth forests and expansive mountain views provides diverse, desirable scenic quality and recreational opportunities. The deep forest also serves to screen use; thus the area can accommodate a fairly large number of users without decreasing its value. Facility development has remained low and stable. Most sites are within the roaded natural recreation opportunity class. Use of the area is relatively heavy in both winter and summer. Summer use is associated with specific sites; winter use is more dispersed. Demand for mountain biking, Nordic track trails, and winter snow play areas has greatly increased in the recent period.

In sum, information about existing conditions, including variabilities, will be extensive, quantitative, and spatially based. In contrast, information about historical conditions and variabilities is highly inferential and much of it qualitative. In many cases, historical condition is based on inference about inferences (e.g., speculating on historic animal distributions based on inferred historical distribution of habitat). Thus for perhaps only one or two ecosystem elements is it possible for the team to follow the detailed, prescriptive, and quantitative approach outlined in the regional ecosystem management guidelines (Manley et al. 1995) . There are some differences of opinion on how historical information would be used to develop the desired condition. To describe this disagreement requires explaining the team's interpretations of sustainability, which is an underlying goal for developing the ecological desired condition of the MJ area (details in appendix 50.2). Several of the team members, especially vegetation, physical, and historic specialists, regard sustainability as the ability to maintain a dynamic and shifting mosaic of vegetation types, seral stages, water flows, and aquatic patterns across the landscape into an uncertain but variable future. Plants and animals would be able to cope with most disturbances without irreplaceable loss of biodiversity. Process is most important, although diversity of composition and structures is desired such that ecosystems can continue to evolve concordant with physical changes (environment/climate/human impacts). In sum, natural processes are favored because they provide resilience and adaptability to change. From a physical perspective, a sustainable watershed allows the natural fluvial processes of the stream channel to determine the habitat condition and populations of aquatic organisms. Thus, carrying capacities of terrestrial and aquatic systems would be set by natural potential of the stream ecosystem. Many team members emphasize this coarse, habitat focus, in which not all conditions and species are managed in intricate matrices of species and areas. Instead, mixes of structures and processes would be favored in levels and intensities that are the consequences of allowing natural process to predominate. The view of these team members tends to be that management for single species should be subordinate to or nested within maintenance of holistic ecosystem properties.

Further, many team members feel that information about the historic condition should not provide a target for the MJ landscape; the goal should not be to replicate specific historic conditions (appendix 50.2). For these team members historic information informs their assessment of present conditions and guides their thinking about the way elements of the ecosystem interact and respond to disturbance. Knowledge of historic vegetation pattern, for instance, provides more understanding of interactions among seral classes, successional pathways in the different forest types, and disturbance/regeneration processes. These in turn allow assessments of the effect (e.g., increased susceptibility to insects and pathogens, changed forest structure, altered species abundances in meadow) of human actions (e.g., grazing, fire suppression).

The MJEMP team is further using information on historic conditions and variabilities as a basis for determining if the rationale behind choice of ecological indicators is valid and for evaluating whether obvious structural diversity or ecological processes are missing or grossly deviant in MJ systems. In thinking about natural and historic variability, most accept that extreme and catastrophic events (e.g., catastrophic fire and flood) are within natural ranges. These events are not, however, within the ranges that would necessarily be included in the desired condition, although they undoubtedly would still occur and must be anticipated. Understanding historic conditions informs these team members about the nature of processes and disturbances that molded the landscape and thus informs about how ecosystem elements might respond to future management or environmental changes (appendix 50.2).

Knowledge of the historic fluctuations and behaviors informs the managers about constraints on levels of accepted human use (e.g., water diversions should be conservatively far within known natural ranges of fluctuation). Team members who adopt the conceptual approach of managing within known natural variabilities, however, have generally considered the concept of assigning ecologically acceptable, quantitative thresholds risky. Most have not felt that their knowledge was good enough to allow assignment of discrete, absolute thresholds, preferring instead to operate far within bounds of variability and approaching values distant from estimated "means" are only to be approached with great caution. Management proposals near the extremes of known natural variabilities would signal a need for further study before such projects were considered.

Not all team members characterize sustainability in this way, nor do they use historic information as described. For some, preservation of certain indicator species and specific habitat is the critical focus of this part in the MJEMP. These members take a single-species or single-indicator approach, advocating that priority for determining forest structure and composition should be given to requirements for viability and persistence of key species. Preserving these habitat structures in conditions desirable to indicators forms their ideas about sustainable management and appropriate goals for desired condition at MJ.

Regarding the intensity of analysis conducted to determine existing and historic conditions, priority was given to geographic areas of ecological importance or vulnerability (e.g., Glass Creek Meadows, red fir forests, streams, and springs), to keystone processes (e.g., fire, forest and meadow seral development, stream-channel morphogenesis), to critical species (e.g., marten, owl, amphibians), and to conditions that seemed already greatly outside natural variability (fire, forest structure, meadow diversity, aquatic diversity).

Public meetings during this phase emphasized information sharing in informal demonstrations. Team members set up tables where members of the public could review information, discuss topics with the specialists, and submit comments. Plenary discussions took place before and after each session. In general, the public supported the ecological indicators chosen, although they seemed unclear (as did the team) in how social values were being measured.

4. Describe the Desired Condition. From a vegetation perspective, the ecologically desired condition is described with reference to seral diversity, stem densities, overstory species composition, canopy closure, presence of fire, patch size, cohort structure, insects and disease, regeneration, and primary understory composition (appendix 50.3). Based on inferred assessments, the present condition of the MJ forests (especially the pine types) has been variably affected by humans. Several processes (fire, insects and disease, successional patterns) and landscape characteristics inferred to have been in the historical landscape are included in the desired condition with reference to historic patterns and abundances, although the historical condition per se will not become a strict target. The emphasis is on reintroducing processes that have been significantly influenced by humans (fire, forest structure, understory composition, patch size, regeneration dynamics) and restoring more natural dynamics.

Glass Creek Meadows is another area that appears to have been significantly affected by humans, primarily through heavy grazing at the turn of the century. Early indications suggest that grazing led directly and indirectly to a change in plant species composition in the meadow, favoring forb diversity at the expense of native grasses. Grazing impacts seem to have acted in concert with climatic changes over the decades toward drier conditions, especially in meadow soils, leading to changes in species composition, gradual succession of pines into the meadow, and to head-cutting and stream-channel incision (though relatively minor compared to effects on the Kern Plateau and in Plumas County). An ecological desired condition, if described in historical terms, would suggest meadow conditions wetter than current conditions, boundaries of the forest maintained back from Glass Creek, grass species dominating forbs, and a normal but stable riparian strip blending the meadow with the stream channel. Because achieving such conditions would require heavy manipulation in the meadow, and because such a scenario is unlikely to be socially accepted (for reasons described later), the final desired condition is not written in terms of rapid return to historical conditions and processes. Rather, the desired condition emphasizes basic ecological conditions similar to those of the present, with focus on improving meadow and aquatic habitat. These goals would be achievable by allowing natural successional processes to unfold with little human intervention.

Aquatic diversity is also greatly outside the range of inferred historic variability. Introduced trout are thriving with very high productivity at least in Glass Creek. The natural condition of the stream is assumed to be fishless. Changes in invertebrate diversity due to the presence of exotic fish are assumed to be great. Habitat exists for mountain yellow-legged frog, although no extant populations are known, and Yosemite toad populations are estimated to be smaller than in the past. Introduced fish and grazing are implicated in amphibian decline.

Despite this significant deviation of current condition in aquatic diversity, this is another area where the MJ team does not favor restoration of historic conditions. Removing introduced trout from the creeks would be difficult and likely to be strongly disfavored by some public groups, especially because Glass Creek has been promoted as a site for recovery of exotic Lahontan trout. More natural (historic) stream-channel conditions—and improved water quality—is favored to restore habitat for other native aquatic species. Restoring populations of amphibians is also favored.

Several ecosystem elements in the MJ area seem to be in good to excellent condition and deviate little from inferred historical conditions and processes. These include water quality and quantity (streams and springs) and air quality. For these, the desired condition will most likely suggest that conditions continue within the present trajectories and variabilities.

Several other ecosystem elements have been difficult to assess for current trends or viability. These are elements for which inventory data of present conditions are scarce or where prediction of historic conditions or future habitat requirements is highly speculative. Examples include spotted owl, marten, mule deer, and willow flycatcher. In the case of the spotted owl, for instance, it isn't clear whether spotted owls use (or would or ever have used) the MJ area as a stable breeding habitat, whether the area was incidentally used historically or at present, or if it has become an expansion area because of changing habitat conditions (anthropogenic or natural) on the west side of the Sierra. It is difficult to assess viability of the owls in the MJ area, or their desired condition, without this knowledge. Thus, the desired condition would not be described using inferences about historical conditions, but would favor the status quo for these species and recommend further study.

Public opinion, although relatively accepting of ecological indicators, has been divided over aspects of the process that relate to desired conditions. During public meetings and in letters to the MJEMP from members of the resident local as well as transient public, strong and opposing desires were voiced about management of specific areas (USFS 1995d). There is a well-organized environmental advocacy group in the eastern Sierra that is dedicated to establishment of wilderness in the released roadless area, opposes development of alpine skiing, and favors minimal development and manipulation in other parts of the MJ area. In contrast, some members of the public who promote developed recreation support the expansion of Mammoth Mountain and development of recreation and geothermal facilities elsewhere in the MJ area. Many members of the nonlocal public travel to the MJ area for winter and summer dispersed recreation and want parking facilities, campgrounds, trailheads, snow-play areas, roads for sightseeing, and Nordic ski trails.

With these social preferences as input, the MJEMP team will evaluate public goals relative to the ecological desired conditions that the team developed. In some cases, the goals will be compatible, and a combined desired condition can easily be written. In other cases, certain public interests will be very different from the ecological desired conditions. In other cases, public interests will conflict among themselves. These will take case-by-case analysis to arrive at specific, integrated desired conditions.

The team's general approach to integrate and resolve these public and ecological goals is to address issues at two geographic scales (appendix 50.3). At the broader landscape scale, desired conditions will be stated predominantly in ecological terms for each vegetation cover type. These will mostly be determined as described earlier, emphasizing landscape conditions that include (but do not mimic) historic processes and dynamic structures as well as reintroduction of processes that have been significantly altered by humans. Deviations as noted occur.

At a finer geographic scale, within vegetation cover types, detailed desired conditions have been developed for specific sites where public interest or resource condition dictate. Desired conditions for these sites are subordinate or nested within the desired condition for relevant vegetation types. For instance, the draft desired condition for the Inyo Craters area is stated in terms of recreation conditions as well as ecological and physical conditions (appendix 50.3). The deviations, however, would be accepted only if they do not have a significant effect on the ecological desired conditions dictated by the vegetation type in which the Inyo Craters lie.

Some social goals will also limit certain extreme conditions from being defined as management objectives, even if they are clearly natural from a historic perspective. For instance, severe, stand-replacing fire is most likely within the range of natural variation for most of the MJ vegetation types. Because of the proximity of Mammoth Lakes and June Lake communities, and because public interest for old-growth forests in the MJ area is high, large stand-replacing fires are not included in any of the desired condition statements. To the contrary, aggressive fire protection is part of the desired condition around these communities, with homogeneous forest conditions that have low risk of severe fire.

Steps 5–7. These steps of the landscape analysis have not been completed or informally addressed, and thus cannot be evaluated at this time.

Question 3: How Effective Have These Methods Been in Reaching the Goals of the Mammoth-June Ecosystem Management Project?

The goal of the MJEMP was to conduct an analysis that would result in the description of future desired conditions (management objectives) for the MJ area. These conditions would, first, provide ecological sustainability of MJ ecosystems and, second, integrate social desires with ecological objectives. The MJEMP process can be assessed for its effectiveness in

- scientific logic and feasibility (especially historical condition and natural variabilities)
- integration of ecological capacities and social values
- logistics and feasibility of the team process
- institutional effectiveness

Together with an understanding of how representative MJEMP is of other Sierran conditions (Question 4), we can assess how valuable this process, as prescribed by the USFS regional guides (Manley et al. 1995) and applied on the Inyo National Forest, would be to other situations in the Sierra Nevada and to SNEP (Question 5).

Scientific Logic and Feasibility

The premise of the USFS regional guidelines (Manley et al. 1995), adopted with minor modification for the MJEMP, relies on fundamental assumptions about ecological sustainability. In the first place is the underlying assumption that sustainability is ecologically meaningful, recognizable, attainable, and practical as a management objective. This assumption is widely debated in ecological, conservation, and political communities. For it to be useful as a management tool, sustainability requires a definition that can be translated into measurable or descriptive (not necessarily quantitative) terms, so that conditions (current, past, future) can be evaluated and monitored relative to attaining goals.

As described earlier, the MJEMP team members differed somewhat in their view of sustainability. Most took a dynamic view of structure, emphasizing the importance of natural processes, recognizing that ecosystem elements shift and change not only in cyclic, recognizable patterns of succession, but also along unique trajectories in response to novel environments and climates. In this view, what is sustained is not a static landscape structure, but resilience and adaptability to change. Change in ecological elements per se is not viewed as contrary to sustainability; indeed, it is considered part of it. A minority of the team emphasized, instead, preserving structural aspects of forest conditions (especially as habitat) over time (e.g., 100 years). In this case, what is sustained is ecosystem structure (current or restored). This view is much less accepting of change in the ecosystems, except in the direction of restoration. In both cases, however, the assumption is that a naturally functioning ecosystem is a sustainable one.

Corollary logic was that conditions significantly modified by human activities might not be sustainable and thus should be avoided or treated with special concern. The question of whether prehistoric humans were different from modern humans in their influence on MJ ecosystems is not central in this context. Rather, actions taken by any humans, prehistoric or modern, that significantly modify natural processes would be considered potentially nonsustainable. Where human actions do not cause significant changes in ecosystem evolution, impacts are considered nonsignificant and in line with ecological sustainability. Thus, the question remains focused on defining the natural, variable (or its proxy, historic) condition and recognizing whether a system is within it or far from it. To address these questions, the MJEMP attempted to practice the logic of comparing existing conditions to inferred historical conditions. The main challenge has come in reliably describing the historic condition of each ecological indicator and the ecosystem as a whole.

Success in this description varied considerably by ecological indicator (table 50.3). An initial factor that differed by ecological indicator was the time depth used to infer historic condition. The team had earlier decided that several thousand years was a time span theoretically appropriate for understanding changes in the MJ ecosystem elements. During that time, climates have been basically modern, yet have fluctuated through warm, dry, cold, and wet intervals, in intensities and durations that could occur in the future. Strong evidence for climate changes and vegetation response in the local region is available from geomorphological studies at Mono Lake (Stine 1994) and paleoecological studies in the eastern Sierra (references and details in Millar [1996] and Woolfenden [1996]). These investigations give detailed information on the exact centuries and duration of dry and wet periods in the recent millennia. This time depth was acknowledged as important for getting beyond the climate (and hence vegetation response) of the last several centuries, which, relative to variability in the last several thousand years, has been at the coolest, wettest extreme.

The ability in fact to accomplish this time depth will be possible only in the case of the Glass Creek Meadows pollen core analysis, which is incomplete. This analysis will provide information on species compositions during the last several thousand years, fire intervals and intensities from charcoal, and the relationship of the volcanic eruptions to forest and meadow succession. Analyses of the downed forest on Whitewing Mountain, secondarily, are giving information on tree species composition in the last 500–1,000 years.

For direct measures of fire (fire scars) and species composition (using ages from stumps to grow the forest back in time) the understanding of historical condition was measurable directly and quantitatively over only several hundred years, from stem cores and stump analyses. Historic photographs (from the late 1800s) and early air photographs were used to estimate conditions 50–100 years ago. Even here, statistically the sample sizes were small, the spatial coverage limited, the investigations minimal, and the baseline post-Euro-American settlement. Primary emphasis is on understanding the historic structure of the fir and pine vegetation types, because they are then subsequently used to infer current and historic wildlife species habitat, abundance, and distribution. Glass Creek Meadows were also a primary focus, because the question of grazing versus natural succession and climate change was important. The fact that these forests and meadows grew during the cool, wet interval, which may not reflect forest conditions in the future, means that the information from the last hundred years may be skewed.

Potentially confounding the analyses further is the uncertain effect that volcanic eruptions have had on forest succession in the past 500–800 years. Tephra, ash, lava, and pyroclastic flows from volcanic vents in the area undoubtedly created conditions for primary succession in some forest and meadow areas. The extent to which current forests reflect response to those conditions or are still under the influence of these effects is unknown. If they are, forest conditions of the past several hundred years may be poor indicators of future conditions.

For some other indicators, time depth used in analysis was extremely short and clearly inadequate for assessing anything near a natural range of variation. For instance, variation in water flows of streams and springs can be known only from direct measurement; such variations have been monitored for ten years at most in the MJ area. No direct information is attainable to extend these data to other periods, and only indirect evidence from general climate can inform estimates of a truly historic range of variation. These limitations were underlined by the team.

For most variables, inferences of historic structure from data on current conditions in the MJ area are based circumstantial evidence left in the forest, estimates of conditions in "healthy" forests, and information gleaned from the literature about the expected behavior of the elements elsewhere. Most of these variables are described in broad, general terms, emphasizing landscape structure and process (forest gaps, species compositions, age class mixtures, regeneration processes, nature of senescence, and disturbance). In only a few cases has the natural range of variation been displayed quantitatively in anything like a metric distribution. From the standpoint of scientific investigation of the historic condition and of statistically validated, quantitative measurement of natural variation, these attempts appear shallow, poorly documented, and limited in time depth, and incapable of even coming close to describing realistic ranges of variation.

If the attempt were to document historic condition and natural variability at the level suggested by the regional guidelines, and to use these measures to define quantitatively precise ecological desired conditions, the MJEMP effort could be judged inadequate. However, because the MJEMP team used historic inferences to inform its understanding of the ecosystem rather than as a target for future management, obtaining precise and quantitative information about the past becomes less important. For reasons described earlier, most of the team members feel that attempting to return current ecosystems to historic architecture is both inappropriate and unattainable. This is an important deviation from interpretations of ecosystem management processes elsewhere. Rather, they argue that a more logical and achievable goal is to favor or reintroduce to the landscape some of the structures and processes that had been present in the natural or historic condition but are missing or greatly deviant from the present. This approach should be more effective, flexible, and open to adaptive management than one that attempts to go back to a specific historic condition.

Further, the team tried to emphasize historic variability most representative of current and anticipated climate variability (i.e., unknown specifics but increasing fluctuations with more extremes). Thus the goal would not be to achieve an exact fire interval of any historic period in the fir forest (which is unknowable for the past and probably inadequately indicates the current or future natural state) nor to restore exact landscape pattern and structure. Rather, the goals are to reintroduce fire per se into the fir and pine forests and to favor the general ecological pattern of regeneration and forest structure that might have occurred in the historic condition and are defensible under present and anticipated climates.

The question arises whether the desired conditions that the team describes, which are general and qualitative, are of value in guiding land management. In other words, is a science-based approach appropriate if the science cannot be done adequately? The MJEMP has cautiously answered this question in the affirmative by modifying the goals for the project. In its use of information, science-based thinking is appropriate. The team is taking an important step by not attempting to set specific quantitative goals when detailed information is not available to support them. Rather, the team acknowledges the need for general statements based on scientific insight from the studies done, which allows for a flexible approach to long-term management. Casting goals in general terms (e.g., reintroduce a missing process such as fire disturbance) should not result in management ambiguity or inability to evaluate specific projects. Rather, casting management objectives in general terms, with emphasis on important process and grossly deviant structural diversity, acknowledges the real situation in which knowledge and understanding, as well as the ability to manipulate forests precisely or prescriptively over long periods, are limited and it's impossible to predict future events (fire, drought). The criticism that historic conditions for many elements in the MJ area could not be analyzed in depth becomes less important. Detailed knowledge is not essential for the team to achieve its modified goals.

Further, the concept of recommended management range as described in the regional guidelines was not quantitatively expressed by the MJ team. Instead, these concepts are discussed in narrative as constraints or supplements to the discussion of ecological desired condition. For instance as described in the case of fire, large, severe fires may be within the historic range in most of the forest types (although rare), but are described as undesirable in the MJ area. As another example, relative species abundances in Glass Creek Meadows at present may likely have been different before heavy grazing in the late 1800s. Wildflower diversity is highly valued by the public, however, and restoration to a historic condition would not only conflict with the probable natural climate/successional trend in the meadows even without grazing but would require heavy manipulation. The desired condition is written to favor a slow and natural succession (not equal to restoration) as is occurring unassisted now since grazing and other impacts have been reduced over the last fifty years.

As a final example, the concept of recommended management range at a recreation site in the MJ area (Inyo Craters) has been described in terms of the modifications needed to promote low-impact recreation (appendix 50.3). These modifications are nested within the ecological goals for the vegetation type and watershed in which Inyo Craters occurs. This use of recommended management range seems appropriate, in that the accepted recreation activities would not cause the system to deviate from natural trends, and is considered to be consistent with the goal of achieving or maintaining ecological sustainability.

In the cases of ecosystem elements for which the current condition itself is not adequately understood and the literature for the area is inadequate (e.g., use of the MJ area by spotted owl), the team is not attempting to develop a historic condition. For these cases, the team will not rely on assumptions about historic proxies or natural range of variation. Instead, the team will favor conditions that maintain or enhance the status quo for these elements, at least until more is understood about their behavior in these east-side environments. This position is defensible and consistent in light of limited information.

The concept of thresholds has been debated energetically by the MJEMP. Although management leadership on the national forest wanted thresholds as guides for later management, and to make defensible decisions, the team was unwilling to set quantitative values to thresholds. The team has felt that (1) information was inadequate to determine defensible ecological thresholds within useful orders of magnitude, (2) ecological thresholds would become management targets, where decisions would be made to "manage to the thresholds," and (3) even with excellent knowledge, thresholds are not static and absolute values. They vary with space, time, disturbance, climate, and so on. Adding these variabilities to threshold setting made it an even more impossible task.

Instead, the team felt more confident making guesstimates for ranges of important conditions. For example, the desired condition for stream flow and spring volume is expressed widely around the range and fluctuation that have been measured in recent years (and is assumed to be an undisturbed and adequate condition). This short measured span would serve as a very general benchmark or reference for any future water diversion projects, recognizing that much wider ranges of climate may occur in the future. Those projects that would not cause deviations more significant than the natural range might be considered acceptable (from the water perspective). Any projects, however, that would cause deviations near the extremes in natural fluctuation would trigger more intensive investigation into water flow and natural variation. Projects that clearly result in conditions outside the natural fluctuations would be considered inappropriate. This represents a realistic approach to the use of historic and existing knowledge for setting management objectives and evaluating proposed projects. It emphasizes the uncertainty at the extremes of variability and would allow for more intensive study and analysis when it was needed.

Significant in the MJEMP process, and clearly implied in the regional ecosystem management guidelines, has been the resistance to propose land designations or to make recommendations for or against any of the existing projects that have been proposed for the area, such as alpine ski development, Research Natural Area, fuel reduction, or wilderness designation. In this regard, the MJEMP successfully separated the concepts of ecosystem capacities and conditions from administrative land classifications. This approach keeps the emphasis where it should be for this phase of analysis: on the primary aspects of ecosystem element viability and sustainability, rather than on the indirect aspect of land allocation. The analysts on the team have focused on what their expertise allows them to do: understand and assess the biological and physical relationships among the ecosystem parts, and infer the requirements and sufficiencies for natural ecosystem functioning. They further do not assume that a particular desired condition has a direct correlation with a land-designation category or management practice. For instance, if maintaining the ancient downed forest on Whitewing Mountain is desired, it may be achieved through several management paths, not necessarily a Research Natural Area. They leave to the next phase in the process—which will involve significantly more public input and normally would invoke the NEPA process—decisions about how best to achieve or maintain the desired landscape conditions. At that time, and only then, might land designations be proposed as a mechanism to aid in achieving these conditions.

Integration of Ecological Capacities and Social Values

MJEMP's primary focus was on analysis of existing ecological conditions and inferring (directly or indirectly) historical conditions. From the earliest meeting, the team recognized the need to develop and analyze social indicators along with ecological indicators. Quantitative measures of these attributes had already been surveyed and mapped for the MJ area (table 50.5). Further, the years of public involvement over the MJ area prior to the MJEMP had yielded enormous amounts of scoping information, which the team took as background for understanding the range of social interests in the MJ area.

Public meetings held during the end of the information-gathering period fielded information about current social desires (USFS 1995d). The public participated much more actively during workshops held later in the process, by contributing ideas about desired conditions.

Public reaction to the MJEMP process in general has been varied. Some groups that have traditionally been involved in eastern Sierra and USFS issues have been quiet or have reserved judgment. Others have expressed concern that options might be foreclosed by the emphasis on ecological sustainability. Many groups feel that the resolution of the MJ area has dragged on far too long and that over the years the USFS has made too many new attempts (new projects) to address management objectives in this area. The prevailing mood is of guarded suspicion about the procedures and success of yet another new project in the MJ area.

The most organized and vocal opposition came midway in the process from members of the local environmental community who reacted both individually and under the auspices of "Friends of the Inyo." Their primary objection was to the landscape-analysis process per se. In letters to the Inyo National Forest (Miller 1994) , personal communications (conversations between B. Hawkins and various members of the public, 1994) , and finally a letter from the organization's lawyer (Emerson 1995) , the group argued that the entire MJEMP process should be subject to NEPA. The group stresses that the development of a desired condition for the MJ area constitutes a decision about how the land will be managed in the future and potentially permits or forecloses certain kinds of activities and land designations. Such a process, they argue, must legally be done within an environmental impact statement analysis, with full public scoping, input, reaction to alternatives, and opportunity to appeal.

Clearly, the group considered the opportunities to meet with the MJ team in the public meetings (to that date) to be inadequate. More importantly, the Friends of the Inyo group felt that the MJEMP's entire landscape-analysis process illegally weakened the public's role in determining management objectives. In the traditional NEPA process, which the LMP anticipated as a cumulative-effects analysis for the MJ area (USFS 1988), members of the public are given a powerful role in determining the fate of land management. Much of the group's concern came from its long-standing desire to establish a wilderness area in the former San Joaquin roadless area and its worry that an alternate fate might result. This sector of the public expresses the opinion that the USFS has reneged on its obligation to conduct an EIS analysis and has chosen a path that purposefully and illegally limits public involvement.

This reaction seems traceable to three situations: lack of full understanding of the landscape-analysis process, opposition to some of the intents of landscape-analysis, and distrust of the USFS to conduct any analyses that might affect land management without full public input. All three might have been mitigated if the team had conducted more public meetings early in the process. Regarding the first, the confusion (and thus suspicion) about the intent and process of landscape analysis is understandable. Ecosystem management as an overall approach is itself new; its implementation as a guiding philosophy is almost without precedent. The underpinnings of forest plan implementation have not been widely described to the public. More importantly, the actual process of landscape analysis is new even to Californian national forests; the MJEMP was following a draft version of the guidelines. USFS team members themselves are learning by participating in the process, so it is not surprising that the public, steeped in the traditional NEPA process, does not clearly understand the intent of landscape analysis.

Opposition to the intent of landscape analysis, as understood by some members of the public, is based on the perceived preoccupation on identifying management projects (e.g., steps 5-7 earlier in the chapter). The public stresses that the objective of landscape analysis should not be to propose actions and projects. This concern stems from opposition to the USFS goal to "do something" on the land and the local public's desire for wilderness allocation in the MJ area, a "do-nothing" alternative. Current ecosystem management thinking in the USFS, however, considers "do-nothing" alternatives as valid (Manley et al. 1995) , but this purported support has not convinced some of the eastern Sierra public.

Related to this concern is the unease which some members of the local public feel about the way landscape analysis takes the focus off administrative land designation. Land designations determine with certain finality the range of permitted or non-permitted activities (e.g., Wilderness or RNA) for a piece of land. The focus of landscape analysis, instead, on desired physical and ecological conditions purposely leaves the issue of actual land management open and subject to change.

Finally, any approach that appears to withdraw opportunities for public involvement and power in decision making is opposed. This perception extends to a distrust of the USFS's ability to carry out unbiased and adequate scientific analyses, to include the range of opinions held by special interest groups, and to manage the land as promised.

The integration of public opinion in developing the desired condition has yet to evolve. Members of the public disagreed among themselves on most of the MJ issues. The MJ team is treating public input in much the same way SNEP has: it will be informed by the input, use good ideas that surface, and try to find solutions that satisfy public desires without compromising ecological requirements. It will not try to solve conflicting public opinion independently of ecological needs.

In sum, the effectiveness of the MJEMP in reaching its goals was hindered by inadequately informing and involving the public in the early stages. More meetings, open dialogue, earnest partnership attempts, and use of public information went a long way toward engendering collaborative attitudes. By late summer 1995, public opinion seemed more supportive and less suspicious. Legal resistance, should it continue from Friends of the Inyo, may force a complete change in the planned strategy and a return to the NEPA process, thus rendering the MJEMP process inefficacious. Should this happen, the opportunity to use this process for other projects on the forest, and potentially throughout the Pacific Southwest region, could be challenged.

Logistics and Feasibility of the Process

Many idiosyncratic, or situation-specific, factors influence whether a planned strategy is effectively conducted. In a team process such as the MJEMP, there are very significant issues of personal leadership, team synergy, incentive, and support; institutional aspects such as agency culture, policy and management history, budget, staff resources, time, and supervisory support; and social factors such as local public issues, political climate, and background societal movements. Only a sampling of these is considered here.

A primary condition enabling the MJEMP team to work as successfully as it has are the individual and collective attitudes of the team leader, members, and supervisors. Although the institutional backdrop began and remained highly pessimistic—local and national budgets were inadequate, forest GIS was unavailable when the project started, forest- and national-level reorganization and downsizing were draining enthusiasms, workforces were being cut, and public pressure was heated—the team maintained a determined, “can-do” attitude. The team members worked on inner initiative. When there was a void, they filled it, creating their own interpretations, GIS, work plans, schedules, and priorities. Diversity in backgrounds of team members led generally not to conflict but to collaboration. Diverging positions, on scientific or technical aspects or in views on project orientation (e.g., management for general forest structure versus single species) did not polarize team members or create barriers to work. A challenge for the team will come in resolving the final ecological desired condition. However, the process itself, with its focus on analyzing landscape conditions and not on a course of management action, relieves the traditional pressures felt in NEPA interdisciplinary teams where specialists often end up polarized in defense of particular disciplinary views.

This is not to say that the team always worked as a unit. Much of the work was done independently or in subgroups, and there was, at times, a fair amount of confusion about the process in general and individual assignments and schedules in particular. Significant aspects limiting effectiveness were the inability to meet intended schedules, conduct planned social analyses, or meet full goals of public involvement.

A major detriment to achieving these particular goals was the lack of dedicated time and priority available to staff to accomplish the work. The routine course of national forest business requires that team members often carry up to twenty or thirty projects (most of them “urgent”) at one time. Forest priorities are established annually but rarely strictly supported or enforced, so staff feel pushed and pulled on a daily basis to reprioritize from one project to the next. Time is grossly inadequate to accomplish within proposed schedules even a fraction of work each specialist is assigned, with the result that all projects are compromised to some extent. With members drawn in different directions by their individual obligations, the ability to focus a large team on any one project such as the MJEMP is an enormous challenge. By contrast, the model many team members hold up as preferable is one in which they could all work on just the MJEMP together for a dedicated time.

The MJEMP team has faced additional challenges to time and work structure because of reorganization of the Inyo National Forest (USFS 1995a) , a process that coincided almost entirely with the MJEMP. Reorganization has instituted major changes in the way staff work and has been enormously disruptive and time consuming. Although in the long run the reorganization should make team projects and landscape analyses such as MJEMP more effective, in the short run, the transition has greatly diminished the working capacity and incentive of many staff members.

In sum, the effectiveness of the MJEMP has depended primarily on personal staff commitment and interest and on general forest priority given to the project, and secondarily on available budgets. Primary factors limiting the logistic effectiveness of the team have been the inability to focus dedicated time on the project, staff overload, inability to foster needed public participation and the roadblocks that resulted, and the fact that forest reorganization coincided with the MJEMP.

Institutional Effectiveness

Several conditions of the MJEMP suggest at first that the landscape analysis might logically be done internally, as a USFS staff effort. The lands under analysis in the MJ area are administered by the Inyo National Forest, technical agency staff representing the major areas under study were available, funding was primarily internal, no land allocations or management prescriptions were to be made, and no environmental analysis (NEPA) was involved. As conceived nationally by the USFS and described regionally in the California handbook, landscape analysis is a technical exercise intended to identify resource capacities, limits, trends, and future conditions. Public participation is encouraged, but no formal process is outlined or required. Projects and treatments, should they be proposed, would come later in an independent process, within traditional NEPA scope.

Under closer scrutiny, the MJEMP actually had several components, some of which might not be appropriately confined to analysis by a single-agency technical team. The MJ area has a large and diverse constituency, consisting of both people interested in the area itself and those concerned about implications for adjacent lands and communities. Further, the role of the MJEMP as a flagship ecosystem management project of the Inyo National Forest meant that it received attention as a pilot process per se beyond the implications for a particular area. Public understanding of what ecosystem management actually entails, or how it will be implemented locally, was poor. The relationship of the Land Management Plan to the

MJEMP, and especially to land allocations or decisions about the future of the landscape, was unclear. Suspicion of the new process was high.

The challenge to the agency in such situations is how to coordinate an interactive, adaptive-management process with stakeholders prior to, and concomitant with, the technical analysis. Information needs to be brought out early, between the agency and constituents and among the different interest groups themselves, about changes in intent since the Land Management Plan, about elements of ecosystem management, and about how and why a landscape analysis would be conducted. Public views on the current and future condition of the area need to be heard early in the process, so that they can be incorporated as needed before the technical team begins.

The actual science work of the technical team belongs to specialists and resource professionals. However, this too is best conducted as an open process with vigorous input and review from experts outside the team and outside the agency. Because the analysis and interpretation of historic variability are not straightforward, significantly more scientific involvement is needed than if a routine resource inventory were being done. Opportunities for the public to learn from the specialists about technical findings in meetings and workshops, as the MJEMP team held occasionally, are important throughout the process.

The appropriate role for the various stakeholders in developing a future condition is less clear. If sustainability could be robustly described with high confidence and little variability by specialists, then the technical team would properly be the primary author. As it is, however, in situations like the MJ analysis, there is such limited understanding of what conditions (averages, ranges, and temporal variabilities) result in long-term ecological sustainability, such disparity in fact about what is socially or ecologically implied by sustainability, and such low accuracy in quantitative estimates, that the process extends beyond science and data collection. More appropriately, during the development of a desired condition the technical team would prepare technical information and analyses, including its best interpretations of long-term capacities and sustainability. The final development of a desired condition, however, is best handled as a mutually interactive, iterative, discursive process among agency staff (decision makers, planners, and specialists) and diverse constituencies (scientists, interest groups, other agencies). This approach will challenge all involved to communicate openly, and will require conscious commitment to a continuing dialectic.

Question 4. How Representative Is the MJEMP of Other Situations in the Sierra Nevada?

Biophysical Aspects

By eastern Sierran standards, the natural environment of MJEMP is unusually diverse for a small landscape and the type of diversity does not directly apply to adjacent landscapes. However, this diversity means that within a small area many of the plant, animal, and physical conditions occur that exist elsewhere in the eastern Sierra (especially Jeffrey pine, sagebrush, east-side meadows and riparian corridors), and in cismontane (red fir, montane mixed conifer), subalpine (whitebark pine/mountain hemlock), and alpine zones. Thus experience with these elements within the MJEMP will apply more broadly to these types and situations elsewhere.

The management condition of the natural environment is relatively representative for these elevations both in the eastern Sierra and elsewhere. Limited roadless areas, large blocks of harvest, and forest structure altered because of fire suppression are typical. East-side pine stands with long histories of partial overstory removal are typical for the Inyo National Forest but atypical for east-side pine in the northern Sierra where clear-cutting has been more common. Recreation development is representative for these elevations and landscapes in the eastern Sierra, as are grazing effects from past and current use.

Management Context

The dominance of USFS administration and ownership is representative of the eastern Sierra but less so for other subregions in the Sierra Nevada. This pattern of ownership makes management issues and strategies within the eastern Sierra unique in the Sierra Nevada. The MJEMP, thus, represents an eastern Sierra subregional model in this regard.

Within the context of the eastern Sierra, the management history of the MJ area samples many of the dominant issues past and present—again with great diversity in a small area—and has probably received more concentrated attention than that of other areas. The current mix of public interest and management issues captures many of the primary concerns in the eastern Sierra. Involvement, participation, and reactions of the public are representative of the eastern Sierra.

Ecosystem Management Model

The MJEMP process is widely representative of approaches to ecosystem management by many agencies and groups, especially those that favor an approach based on historic conditions, ecological sustainability, and natural variation. In particular, it reflects the most recent and specific interpretations and guidelines developed at the national and regional USFS levels. As such, the approaches adopted by MJEMP are intended to be repeated for most of the lands under USFS jurisdiction throughout portions of the Sierra Nevada within the Pacific Southwest region.

Question 5. What Can Be Learned from the MJEMP Case Study?

Local Natural Environments and Local Social Issues

The approach of comparing existing conditions to inferred historic conditions appears appropriate for most ecosystems within the MJ area at the level of analysis intended for the MJEMP. The approach is applied without obvious problems at a more qualitative, inferential level than implied by the USFS regional guidelines (Manley et al. 1995). This application is allowed by the MJEMP team's modified approach, which uses inferred historic condition to inform the understanding of current and future ecosystem relationships rather than as a target to mimic. The consequences of these situations are that (1) quantitative targets, specific targets, and detailed descriptions of desired conditions will not be developed, and thus a more flexible approach will be enabled, (2) historic conditions (and range of conditions) are not used to set targets for a future that mimics the past, and (3) important ecological processes will be favored for reintroduction where practical and implied by scientific analysis. These are realistic advances in ecosystem management thinking, acknowledging inevitable dynamism of the ecological future in the MJ area and the fact that the present and future are different enough from the past that there is little reason to consider "going back" even if it were practical.

For some attributes it has been extremely difficult even to understand current conditions, and thus it is not yet possible to estimate historic condition with an acceptable level of confidence. For these attributes, the team recommends that the status quo be maintained or that, within best professional judgment, changes to improve conditions be made where they are judged to be degraded.

To the MJ ecosystem as a whole, the approach taken has the benefit over traditional NEPA analyses in that all elements are considered together, thus providing for understanding of ecosystem interactions and cumulative effects. Because the process is proactive and holistic (albeit at a relatively superficial level), it provides a broad baseline for understanding effects of specific projects that might be proposed in the future and avoids reactive project management.

With several very important exceptions, from the standpoint of the local community, many of the social vales that both local and adjacent communities have expressed are being incorporated into the desired condition for the MJ area. Important exceptions include the desires to retain legal public participation and appeal privileges at all stages of the analysis and to set management designations on certain areas within the landscape.

Sierra Nevada Ecosystem Project

In many ways, the MJEMP represents a mini-version of SNEP although it does not represent the full diversity of conditions SNEP must contend with in the Sierra Nevada. However, SNEP may be guided in the value and limitations of the approach for assessing conditions using a historic perspective, in the choice and rationale of ecological indicators, and in the specific application of the method of using historic conditions and natural range of variation in projecting future management objectives. SNEP could take the lesson from MJEMP that because historic conditions can never be known precisely, and because current and future natural trends (even without human presence) may be very different from the past anyway, the goal is to be informed by inferences about the past. This knowledge would best be used in making broad assessments of future conditions and choices for the future.

SNEP should be guided by the lessons learned at MJEMP of the importance of early, dedicated, and sincere involvement and communication with the public. Distrust of top-down approaches, institutional control, academic advice, and holistic solutions to problems will apply also to SNEP. Early disclosure and communication mean a greater likelihood that the results might be understood, accepted, and used.

Many of the procedural difficulties encountered on a minor scale with MJEMP involving team participation, focus, leadership, decision making, internal conflict, networking, and communication with communities of peers also have challenged SNEP. Clearly, large, interdisciplinary teams require working relationships, personal behaviors, and ground rules with which scientists and natural resource managers alike have as yet limited experience.

Situations Elsewhere in the Sierra Nevada

As mentioned earlier, the MJEMP is representative of anticipated future planning throughout the national forests of the Sierra Nevada, and thus the procedural lessons learned here apply broadly. Results from the MJEMP apply to conditions on private lands, lands with checkerboard ownership, and other federal agency lands only to the extent that management or institutional approaches resemble those of the USFS Pacific Southwest region.

Significantly, the questions raised by the attorney for Friends of the Inyo regarding the legality of the landscape process in regard to NEPA analysis pertain much more broadly than to the MJ area or the Inyo National Forest alone. Should this issue be pursued, it could cause major revisions of the nascent ecosystem management guidelines and could thus affect the way USFS landscape analysis is conducted throughout the Pacific Southwest region. Concerns expressed by the letter might have been alleviated by earlier and more extensive public involvement. Detailed analysis of alternative approaches that might result as a consequence of such public reaction are beyond the scope of this report.

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APPENDIX 50.1

Summary of Management and Land-Use History of the Mammoth-June Study Area

INTRODUCTION

The Mammoth to June Study Area is located on the east side of the Sierra Crest, between the Town of Mammoth Lakes and the Community of June Lake. The 36,000 acres of land within this area are part of the Inyo National Forest's "Mammoth to June Ecosystem Management Project". This report summarizes the management history of the Mammoth to June Study Area from the time it was designated as part of the National Forest System until the present date. It is organized into sections that address management plans, logging history, grazing history, access development, and recreation. This information was compiled from records at the various offices of the Inyo National Forest, so the focus of the report is on those resource areas of interest to the Forest Service. This report does not include information about the use of the area by native americans or by the early settlers prior to the reservation of the land from the public domain.

OVERVIEW

The western portion of the study area was designated as part of the Sierra Timber Reserve on October 1, 1890. The remainder of the area was added on July 25, 1905, to the then renamed Sierra National Forest. This area was transferred to the Inyo National Forest in 1908. Grazing dominated the use of the study area at the turn of the century, often with little or no restrictions. Timber harvest within the study area was limited to several hundred acres in the southern part of the area. Grazing use continued and timber harvest increased after the area became part of the Inyo National Forest. Recreational use increased in the 1920s, particularly in the Crestview area. Both management and use of the area since the 1920s has been a balance of recreation, timber harvest, and grazing. Roaded access to the area increased slowly, primarily associated with timber harvest. Approximately one third of the area remains unroaded.

MANAGEMENT PLANS

The general orders for Rangers at the turn of the century were to put out fires and to keep trespassing sheep out of the Reserve. There were no Rangers east of the crest until 1903, and when they did arrive they had their hands full chasing sheep and putting out fires until more help arrived in 1905. As the staffing of the Inyo National Forest increased through 1910, resource management became more focused and policy was established. Grazing administration remained the focus of planning efforts through 1920. Recreation and timber management plans were started in the 1920s, and grazing plans were revised. Copies of those plans have not been located at this time.

Integrated Use Plan

The earliest planning document found in the records is the Integrated Use Plan prepared by Forest Supervisor Neal M. Rahm in 1950. The purpose of the plan was to provide a coordinating key between all uses, facilitate administration decisions, resolve conflicts between uses, and assure continuity and consistency of Forest Administration. The plan divided the Forest into eight (8) Forest Units. Each unit was defined by conflicts that were occurring within the area, and boundaries were drawn without regard to administrative boundaries. The Forest Units could be further divided into Zones, which were based on a combination of natural features, resources, and uses.

The Mammoth to June area was within the Mammoth-Mono Unit, Mammoth Zone. The Mammoth Zone included the area from June Mountain south to Rock Creek. The north, west, and east boundaries of the Mammoth Zone are the same as the boundaries set for the Mammoth to June area. Recreation was the dominant use of the zone, particularly within the Mammoth Lakes and Deadman Creek areas. The plan called for managing the area for Rec-Wildlife, with other uses allowed if they didn't conflict with the primary use. This plan was intended to cover a ten year period, but in fact guided management until 1970. The following section summarizes the pertinent management direction:

> Timber: No timber cutting will be permitted unless non-detrimental to recreation; That an adequate highway strip be preserved along Highway 395 for scenic values.
>
> Recreation: Acquire lands in Deadman Area; Develop Deadman-Glass Creek area to relieve local pressure
>
> Lands: Reserve government land for public service sites and encourage commercial development on private land.
>
> Winter Sports: Prepare development plans and issue prospectus for a high class winter sports facility.

Multiple Use Plan

The next generation of comprehensive plans were the Multiple Use Plans. These plans were developed for each District, with land classification based on a standard framework of descriptions developed for the Northern California Subregion of the Pacific Southwest Region of the National Forest System. The standard guide contained definitions, characteristics, management direction, and coordinating requirements for each land classification. District Plans were attached to the subregion Management Guide, and provided management direction and coordination requirements specific to an area. The Mammoth to June Study Area is located in two districts, so management under this planning effort was directed by the Mono Lake District for the north half, and the Mammoth District for the south half. The Multiple Use Plan for the Mono Lake District was prepared by District Ranger Harold Cahill on 3/23/70, and approved by Forest Supervisor John Radel on 3/24/70. The Mammoth District Multiple Use Plan was prepared by District Ranger Richard Austin on 2/11/71, and approved by Forest Supervisor Radel on 2/16/71.

The Mammoth to June area was classified into several zones. The San Joaquin Ridge was part of the Mammoth Crest Zone. Management Direction for this zone was to safeguard the natural environment, and protect interesting and unusual features. Specific direction for this zone included direction to avoid expanding the transportation system in the zone.

The majority of the Mammoth to June study area was classified as general forest zone, further divided into three units. The northern end was part of the Hartley Springs-June Mtn-Glass Creek & Deadman unit (GF-1)on the Mono Lake District. The southeast quarter was part of the Sawmill unit (GF-1) on the Mammoth District, and the southwest quarter was part of the Mammoth Fringe unit (GF-2), also on the Mammoth District. All three units recognized the importance of recreation in this area. Although the subregional direction for this zone was to emphasize sustained yield of timber, the District plans focused on the recreational use of these areas. Timber harvest was allowed on a limited basis, and the practices needed to enhance the recreation value of the forest. The Mammoth Fringe and Sawmill units also provided direction for expanding overnight camping areas, as well as exchanging land to allow for expansion of the community of Mammoth Lakes.

Both districts also identified Travel Influence zones that were located within the Mammoth to June area. The direction for these zones was to maintain or enhance beauty and attractiveness, and to develop suitable recreational sites. The travel influence zones included Mammoth Mountain, the Mammoth Fringe, Minaret Summit road, Inyo Craters road, Sawmill Road, Highway 395, and the Hartley Springs road.

Mono Plan

Shortly after approving the Multiple Use Plans, the Inyo National Forest and Mono County signed a “community-forest” agreement to produce a land management plan for 300 square miles of private and National Forest System land. The Mono County Board of Supervisors approved the Mono Plan for the private land around Mammoth Lakes in 1976. The sections of the Mono Plan that applied to the National Forest needed additional work to comply with the National Environmental Policy Act, the National Forest Management Act, and the Geothermal Steam Act. As a result, the Mono Plan was reviewed and converted into the Land Management Plan for the Mammoth-Mono Planning Unit.

Land Management Plan for the Mammoth-Mono Planning Unit

The Mammoth-Mono Planning Unit covered 695 square miles of National Forest Land from Mono Lake to Crowley Lake. The goal of the planning effort was to develop a plan that met the requirements of the National Forest Management Act while responding to the Mono Plan that was jointly developed by the Forest Service and Mono County.

This planning document was the first land management plan to address the “build-out” of winter sports facilities and also the development of geothermal resources. Both issues related directly to resources within the Mammoth to June Study Area. The ski area development issue was identified as a key issue in the Record of Decision for the plan. Some alternatives would have proposed development to support 71,000 skiers-at-one-time (SAOT). This level of development would have required the connection of the Mammoth and June ski areas, as well as development of Sherwin Bowl. The connection of Mammoth and June would have been along San Joaquin ridge, affecting approximately 14,000 acres of roadless area. The issue of allocating the “Roadless Areas” was deferred to the Roadless Area Review and Evaluation process that was being completed at the national level, but the other issues were addressed in the plan.

The Land Management Plan, which was approved on May 23, 1979 by Regional Forester Zane G. Smith, allocated National Forest Lands into various management zones. The San

Joaquin ridge and Glass Creek area was allocated to Zone C. The management objective for Zone C was to emphasize watershed, visual quality, recreation, and fisheries. Policies provided for activities that maintained visual quality, forest health, and habitat productivity.

The upper Dry Creek watershed was allocated to Zone D. This was the winter sports allocation, and the emphasis was on watershed, recreation, and visual quality. Policies provided for a cap on ski area development, set at 31,000 SAOT for the forest. This cap would be shared by the Mammoth and June ski areas. Policies also reserved the area connecting the Mammoth and June ski areas, as well as Sherwin Bowl, to allow for further evaluation and development of winter sports sites if development at Mammoth and June could not meet the 31,000 SAOT capacity.

The Glass Creek, Deadman Creek, and the Crestview rest stop area was allocated to Zone E, which was the developed recreation allocation. The emphasis was on watershed, visual quality, recreation, and fisheries. Other activities were allowed as long as they supported the emphasis items. This allocation applied to all the major recreation centers in the planning unit, and the plan did not provide any specific direction for the Mammoth to June area.

The majority of the study area was allocated to Zone G. This allocation emphasized watershed, timber, visual quality, and wildlife habitat. Recreation, timber, and grazing were all recognized uses. Policies provided direction for maintaining a visual quality objective of retention around Highway 395, the Inyo Craters Road, the Hartley Springs Loop Road, the Deadman Creek Road, and the Sawmill Road. Protection and enhancement of important wildlife habitats located in the vicinity of Wilson Butte and Inyo Craters were also recognized.

The issue of geothermal development was considered and a Geothermal Management Zone was identified and overlayed on top of the other Management Zone allocations. The purpose of the overlay was to identify areas suitable for leasing, but no leasing action would occur without additional studies. The southeast portion of the study area was included in this geothermal overlay.

Roadless Area Review and Evaluation

The Roadless Area Review and Evaluation process was completed for a second time at the national level in the late seventies. This process, referred to as RARE II, reviewed the existing roadless areas and evaluated their suitability for inclusion into the National Wilderness System. The western third of the Mammoth to June Study Area was part of the larger San Joaquin unit that extended into the Sierra National Forest. Two issues factored into the eventual recommendation, one was the potential ski area development along San Joaquin ridge, and the other was the construction of the trans-Sierra highway from Mammoth to the central valley along the San Joaquin drainage. In the end, San Joaquin ridge was left out of the proposed wilderness to maintain the potential for ski area development, and the San Joaquin drainage was added to the adjacent wilderness areas, eliminating the route for the trans-Sierra highway.

Geothermal Leasing for Lease Block II

The Forest Service and BLM jointly prepared an Environmental Assessment to determine what National Forest Lands in Lease Block II of the Mono-Long Valley Known Geothermal Resource Area (KGRA) were suitable for leasing. The eastern two thirds of the Mammoth to June study area were part of Lease Block II. The result of that assessment, approved by Forest Supervisor Eugene Murphy and District Manager Robert Rheiner on May 14, 1984, was to approve leasing with restrictions. A lease was issued in 198?. One of the key restrictions was a limitation on surface occupancy in key areas. This restriction applies to much of the lease in the Mammoth to June Study Area.

Inyo National Forest Land and Resource Management Plan

The Land and Resource Plan, otherwise known as the Land Management Plan or LMP, is the current planning document for the Inyo National Forest. The LMP was structured around Forest-wide Standards and Guidelines (S&G's), Management Prescriptions, and Management Areas. The S&G's are broad direction for all the resources on the Forest. The Management Prescriptions are focused direction for particular resources and are applied to a specific area of the forest, however, one Management Prescription can be applied to several different areas. The Management Areas are designated geographic areas defined by issues, opportunities, uses, or topography. Direction is more specific at the Management Area level.

The LMP was primarily a land allocation or "zoning" document, in that certain activities are allowed by the LMP depending on the Management Prescription. Considerable controversy developed over the allocation of the area between Mammoth Lakes and June Mountain, particularly as it related to ski area expansion, geothermal development, timber harvest, and recreation development. The Forest assembled a "common ground" workgroup from a cross-section of interests to evaluate these issues. The workgroup found that the detailed resource information necessary to fully evaluate the issues, as well as the future of the area, was not available. The individual values and desires of group members were also very different. Faced with the combination of different opinions and lack of information, the group was unable to reach consensus on all the issues. They did agree that further analysis was needed before any significant development took place in the area. That recommendation lead to direction in the LMP that defined the Mammoth to June Study Area, as well as creating the foundation for the Mammoth to June Ecosystem Management Project.

The LMP, which was approved by Regional Forester Paul F. Barker on August 12, 1988, allocated the Mammoth to June area to seven different Management Prescriptions (MP). The

Mammoth Mountain Ski Area was allocated to MP 13, Existing Alpine Ski Area. The purpose of this prescription is to manage the existing downhill ski areas for public use. San Joaquin ridge, upper Glass Creek, and portions of the Hartley Springs area were allocated to MP 14, Potential Alpine Ski Area. The purpose of this prescription is to maintain the potential for alpine ski development, and to retain the value as potential downhill ski developments. The Inyo Craters, Glass Creek, and Deadman Creek areas were allocated to MP 12, Concentrated Recreation Area. The purpose of this allocation is to manage the areas to maintain or enhance major recreational values and opportunities. The center section of the area was allocated to MP 16, Dispersed Recreation. The purpose of this prescription is to maintain the potential for both winter and summer high quality dispersed recreation opportunities. Glass Creek Meadows was allocated to MP 17, Semi-Primitive Recreation. The purpose of this prescription is to limit vehicular access to existing routes to protect and maintain recreation and wildlife values. The eastern section of the area was allocated to MP 9, Uneven-aged Timber Management. The purpose of this prescription is to manage suitable timberlands for the production of wood products using silvicultural treatments that maintain options for other resource emphases during the planning period. The final allocation of MP 11, Range, was applied to a small section of the southeast corner of the study area. The purpose of this prescription is to maintain or increase forage production and achieve uniform livestock distribution through maintenance or expansion of structural and nonstructural range improvements.

The allocation of the released roadless area to MP 14, and Glass Creek Meadow to MP 17, remain extremely controversial. There is strong support for opposite positions regarding future use of this area. One side would like to see the area added to the adjacent Ansel Adams Wilderness, while the other side supports increased recreational use of the area and leaving the option of ski area development open.

The issue of geothermal development leasing had been settled prior to the LMP, so the existing lease conditions were made part of the plan. All the allocations within the lease block are subject to the pre-existing rights of the leasee.

TIMBER HARVEST

The first recorded timber sale on the Inyo NF occurred in 1908, near Mammoth and in the extreme southern portion of the Study Area. The records do not indicate a purchaser, but since Mammoth boasted several small mills at this time, it no doubt went to a local mill for local use. A 1907 vintage map located at the USFS office in Lee Vining gives the location of "Home Lumber Company," as very near the present day Shady Rest Park and ballfields. It is presumed this is why the "Sawmill Cutoff Road" and the "Sawmill Timber Compartment" are named as they are.

The first mention of any timber planning effort occurs around 1920, the previous decade apparently being spent primarily on grazing issues. A timber map prepared in the mid-1960s shows several small timber sale areas, located immediately north of Mammoth, which were sold and cut in the years 1923 thru 1930. Volumes from these cuttings were probably relatively small and went to feed the small mills in Mammoth, which in turn supplied the agriculturally based communities in the Owens Valley.

There is no indication of any formal timber harvesting in the Study Area during the 1930s. The Inyo NF Integrated Use Plan of 1949-50 includes a history of past uses and trends, but gives no report on timber activities during the 1930s. The creation of the Civilian Conservation Corps (CCC) in 1933, apparently had the greatest influence on the Inyo NF during the 1930s. Roads, trails, campgrounds and Ranger Stations were all constructed by the CCC during the 1930s.

Timber planning and harvesting records improve markedly, beginning in the 1940s and continuing on up to the present day. The following is a list of all known sawlog timber sales in the Mammoth to June Study Area. While a fair amount of commercial fuelwood sales have occurred in the Study Area, their volume is relatively small in comparison and the records on these sales prior to 1970, are somewhat sketchy and incomplete.

Sale Name	Year	Volume	Location
Sawmill(?)	1923-30	?	Near Shady Rest Park
Inyo	1944-45	?	Sawmill Timber Compartment
West Crater	1946-47	?	Dry Creek area
Hartley Springs	1952-53	10.0 MMBF	Hartley Timber Compartment
Deadman Creek	1957-58	7.5 MMBF	Dry Creek/Glass Timber Compartments
Sawmill(?)	1958-59	?	East side of Sawmill Comp.
Upper Deadman	1962-63	8.5 MMBF	North side, upper Deadman Road
Shady Rest	1963-64	6.9 MMBF	South end of Sawmill Comp.
Sawmill	1964	10.6 MMBF	Sawmill Compartment
Hartley Springs	1967	?	Hartley Timber Comp.
Middle	1967-71	8.2 MMBF	North end of Dry Crk. Comp.
Mammoth Fir	1970-75	3.5 MMBF	Sawmill Timber Compartment
Glass	1972-74	4.7 MMBF	Glass Timber Compartment
Dry Creek	1978-82	9.9 MMBF	Dry Creek Timber

Prior to 1980, all harvesting in the Study Area was most likely overstory removal in nature. The old, high value trees were cut, leaving the generally smaller, younger trees to continue growing. The Study Area contains no large, old clearcuts or plantations from the past. Several factors contributed to this lack of clearcutting. In general, the Study Area was well stocked with younger trees, which were not yet large enough to be valuable for lumber and so were left behind after cutting. Also, management direction for the Study Area in particular and Forest Service land in general, favored cutting methods other than clearcuts.

In the 1949-50 Inyo NF Integrated Use Plan, the Mammoth to June Study Area falls into the Mammoth and June Lake Loop Zones. In both of these zones, the Use Plan directs water, recreation and wildlife to take precedence over timber when conflicts arise. Specifically, no timber harvesting was to occur in these zones unless “non-detrimental to recreation.” The only exception was to be an unspecified area of Dry Creek where “no recreational value exists.” This direction obviously was not meant to exclude timber harvesting, as the type of harvesting that began in the 1940s continued in the 1950s, but rather was meant to prevent wholesale losses in recreational opportunities that might occur if recreation potential did not exist.

Even by 1950, the growth potential for recreation in the Mammoth area was recognized. The population and economy of Los Angeles was growing, roads and automobiles were improving and plans for a ski resort at Mammoth Mountain were in the works. So, in the 1950s and early 1960s, Mammoth grew slowly and timber harvesting continued, with respect to future recreation needs. By the late 1960s, most of the eastern half of the Study Area had been harvested at least once. Typically, 30 to 40 % of the overstory had been removed, but in some areas, 60 to 70% of the overstory had been removed by 1970. The harvesting was concentrated in the eastern half of the Study Area, as this was where the more valuable pine was located. Some harvesting did occur in the fir-dominated regions of the Study Area, but the level of harvest was much lighter than in the pine-dominated areas.

By the late 1960s and early 1970s, growth in Mammoth had reached and begun to surpass its earlier expectations. At the time of publication in 1971, the Inyo NF Multiple Use Plan reported that Mammoth was the “fastest growing community in the country.” The direction in this plan for the area immediately north of Mammoth, was to maintain it for recreation needs. The direction did not preclude timber harvesting from occurring, but generally supported past direction, which gave precedence to possible future recreation needs, namely campgrounds. The growth figures for Mammoth seemed to indicate the needs would come sooner, rather than later. Further to the north in the Study Area, potential recreation needs also influenced timber activities. The Multiple Use Plan recommends timber roads be coordinated with recreation needs and that a continuous green cover be maintained, even if this means only partial overstory removal cuts and multiple entries. In general, the direction was to maintain a quality recreation environment, by harvesting timber on a selection or very small group basis.

Timber harvesting in the 1970s, in the Mammoth to June Study Area more or less followed the selection harvesting direction given in the Multiple Use Plan. Despite Mammoth’s growth in this decade, no new campgrounds were constructed in the Study Area. Additionally, the much discussed northward expansion of Mammoth Mountain did not occur. In 1979, the Land Management Plan for the Mammoth - Mono Planning Unit was released. This plan marked a significant change for timber management in the Mammoth to June Study Area. Previously, timber had been ranked behind water, recreation and wildlife when conflicts arose. The Mammoth - Mono Plan of 1979, lists timber second only to watersheds in order of management emphasis. The plan lists as a goal for the Mammoth to June area, as well as much of the rest of the timbered lands on the forest, the following: “Irregular size structured stands of healthy, vigorous trees within and adjacent to existing or potential recreation development sites, scenic roads and key wildlife habitat: generally even size structured stands of healthy, vigorous trees on all other productive forest land.” This seems to open the door for more intensive harvesting of large, old trees via overstory removal and clearcutting. Previous plans used more restrictive language when describing allowable harvesting in the Mammoth to June Study Area.

The 1979 Mammoth - Mono Plan solicited public input, but public comment was directed toward ski area expansion and geothermal development in the Mammoth area and no mention was made of any comments on the timber program. Apparently, old growth trees and old growth habitat were not issues yet. This new plan was the guide for the early and mid 1980s, and under this plan, there was indeed a change in timber harvest techniques. Where understory stocking was deemed inadequate, a few, small clearcut units were established in the Sawmill and Dry Creek Compartments. Overstory removal became somewhat more intensive, leaving fewer large trees standing.

Also in the late 1970s, serious planning efforts were begun for timber harvesting in the Earthquake and Deer Mtn. Timber Compartments. These compartments sit at the base of the San Joaquin Ridge and are comprised mainly of stands of large diameter, pure red fir and red fir-pine mix. Some areas of these compartments had seen harvesting many years earlier, but the harvesting was relatively light and so in large part, the Earthquake and Deer Mtn. compartments had retained most of their old growth forest characteristics.

By 1980, the data collection and environmental analysis work were complete. Plans called for harvesting of 11.5 MMBF of red fir and Jeffrey pine sawlogs, from scattered areas within the Earthquake and Deer Mtn. compartments. A forest road was to be constructed from just west of the Mammoth Mtn. Main Lodge, northward, passing on the west side of Crater Flat and ending at the Deadman Creek Road, at a point west of the Deadman Campgrounds. The road was to be multi-functional in design, serving both immediate timber access needs, as well as providing long-term recreational access to the area.

For a number of reasons, the Earthquake - Deer Mtn. Timber Sale EA was never signed by the Forest Supervisor, and hence, never implemented. From early on in the process, there was internal Forest Service opposition to the proposal. Letters and other documents included in the EA indicate that recreation and wildlife issues were the primary reasons for opposition to the proposal. Wildlife staff felt the ability to regenerate red fir by planting was still unproven, that the wildlife input was completely inadequate, especially for mule deer and that the proposed road construction would fragment the wildlife habitat. Recreation staff felt the Inyo NF, and this project area in particular, are more suited for recreation use, rather than timber procurement. They were concerned that Nordic skiing potential for the area would be compromised if the harvesting were allowed to occur.

The Earthquake - Deer Mtn. issue dragged on into the early and finally mid 1980s before final resolution was reached. In the early 80s, much of the Earthquake and Deer Mtn. Compartments were included in the Roadless Area Review and Evaluation II (RARE II), with potential for wilderness designation by the U.S. Congress. In 1984, wilderness legislation did pass, but the San Joaquin Roadless Area, which included the project area, was not included. By this time, the EA was getting somewhat out-of-date, EA guidelines were changing and the new forest plan for the Inyo NF was on the horizon. Additionally, local environmentalists were becoming organized and opposed the timber harvest plans on the grounds that it would preclude the area from any future, possible wilderness designation. In 1986, as part of the work on the new Inyo NF Land Management Plan (LMP), it was determined that no timber harvesting would occur in the red fir belt at the base of San Joaquin Ridge, for the life of the LMP (ten years). This quite clearly included the Earthquake - Deer Mtn. project area and so with removal of the red fir from the timber base, the issue was finally resolved.

Technically, current direction for timber is to be taken from the Inyo NF LMP, which was approved in 1988. More practically, current timber direction is taken from the guidelines put forth from the Washington Office, in the form of Ecosystem Management. The LMP has effectively carved up the Mammoth to June Study Area into a wide variety of land management prescription areas. Most of the Study Area is classified as either “Potential Alpine Ski Area” or “Dispersed Recreation.” Roughly the eastern third of the Study Area (portions of the Hartley, Glass, Dry Creek and Sawmill Compartments) is classified as “Uneven-aged Timber Management.” Aside from the mostly pure stands of red fir in the Earthquake and Deer Mtn. compartments, timber harvesting could continue, as long as uneven-aged management methods were used, openings were kept small and harvesting in general was not detrimental to higher value resources in the area.

In reality, aside from salvage harvesting and small fuelwood sales for local consumption, no timber harvesting has occurred in the Study Area since implementation of the LMP. In-house and public concerns about old growth trees and old growth habitat, and more recently the need for furbearer population surveys has curtailed the timber activities in the area. The concern over old growth gave rise to the Inyo NF Old Growth Management Strategy, which has resulted in a mapping out of old growth retention and recruitment areas throughout the Forest and a series of corridors connecting these areas. The development of this old growth issue slowed or stalled work on timber harvesting plans during the late 80s and early 90s. The furbearer issue is ongoing and has currently stopped progress on the Dry Creek Timber Sale EA. This EA calls primarily for harvesting to be accomplished by thinning, with retention of nearly all old trees (180 yrs or older) within the sale area. However, wildlife staff have felt furbearer data are incomplete, with respect to population numbers and locations at various levels of canopy closure.

Since the mid 1980s, public interest and public comment on timber management on the Inyo NF has greatly increased. Clearcutting, loss of old growth trees and old growth habitat, loss of forest diversity, deer cover issues, excessive road systems and conflicts with numerous animal species and recreation uses have all been cited as concerns by the public. A relatively small, but sophisticated and well educated group of citizens have consistently commented on timber harvesting proposals over the past ten years. They are well connected to larger environmental groups and have been a rather effective voice for change, with respect to timber management on the Inyo NF.

A more recent and important change for timber management on the Inyo NF, has been the 1994 Ecosystem Management (EM) direction out of the Washington Office. EM, along with the more recent Forest Health initiatives, have provided support for a timber management program which looks at current forest conditions and desired future conditions, with an eye toward improved ecosystem health. On the Inyo NF and within the Mammoth to June Study Area, this has given rise to a timber program which focuses on reducing the over-stocked stands to former, healthier, more sustainable levels. By and large, this will be accomplished by thinning cuts. The timber sale in the Hartley Compartment, scheduled for sale in 1995, is an on-the-ground example of this new timber management direction. The EA for this compartment was appealed to the Regional and Washington levels, but the appeals were turned down. Interestingly, some members of the public traditionally opposed to timber harvesting have expressed some positive comments on the new timber direction on the Inyo NF. Many others, however, remain steadfastly opposed to virtually all timber harvesting, regardless of harvesting motive.

GRAZING HISTORY

The grazing history in the eastern Sierra, and presumably the Mammoth to June Study Area, dates back to the middle of the 19th century. Reports indicate that huge numbers of livestock formerly grazed on what is now Inyo NF land. Unrestricted by regulation, these bands of sheep and herds of cattle roamed throughout the area, in search of good forage.

The creation of the Inyo NF in 1907, provided the opportunity to put grazing under regulation. A shortage of personnel made the regulating process difficult, at best. The 1949-50 Inyo NF Integrated Use Plan reports that initial efforts at control consisted of nothing more than placing the livestock under permit. Actual management plans did not begin to appear until the 1920s, but numbers of animals allowed appear to reflect demand, rather than a carrying capacity dictated by the range condition. Beginning in 1944, an aggressive adjustment plan was initiated to bring permitted AUMs in line with range capabilities and to solve present and/or potential conflicts with higher ranking resources. By 1950, the AUMs on the forest as a whole, for both cattle and sheep, had been reduced by over 40 percent. Interestingly, this reduction was achieved not so much by a reduction in actual animal numbers, but by a reduction in the number of days animals were allowed on a given range allotment.

Within the Mammoth to June Study Area, there are currently two allotments. The June Lake allotment runs from the south June Lake Junction, down Highway 395 to Glass Flow Road, then west to San Joaquin Mtn, including Glass Creek Meadow, then north to include Yost Meadow and then northeast, back to south June Lake Junction, excluding the town of June Lake. Within the Study Area, 1800 sheep are allowed on this allotment, with a use period of July 1st thru August 31st. In actuality, the current sheep use of this portion of the allotment is closer to one month, rather than two months. Typically, the sheep head up toward the Hartley Springs area and spend two or three days in this area, then move up to Glass Creek Meadow for three to five days and finally over to Yost Meadow for a week to ten days. They then return out by the same route they followed in, stopping as they did on their way in. Actual days in each location vary, depending on the availability of forage.

The Sherwin-Deadman allotment covers much of the Study Area south of Deadman Creek, west of highway 395, north of highway 203 and roughly east of a line from Lower Deadman Campground, south to Deer Mtn. and southeast to near the Mammoth Ranger Station, staying out of the Mammoth Knolls and Inyo Craters areas. Within the Study Area, 1500 sheep are allowed on this allotment, with a use period of July 1st thru September 30th. In recent years, the permitee has come onto the range later, left earlier and has had only around 1000 sheep, rather than the 1500 he is allowed. Typically, the sheep enter the allotment from the south, crossing highway 203 near the junction with highway 395. The sheep are herded north and west throughout the allotment, avoiding areas of high public use and stopping short of Deadman Creek, where no grazing is allowed. Since no water is available, the permitee trucks all water into the sheep. After grazing is complete, the sheep exit the allotment to the south, again crossing highway 203.

Old records for both allotments indicate relatively stable actual numbers of sheep on the allotments over many years. Records for the June Lake allotment date back to 1914 and records for the Sherwin - Deadman allotment go back to the 1940s. While the actual numbers have remained consistent with today's figures, the permitted number of days on the allotments have been sharply reduced. Formerly, these allotments were eligible for grazing from early June thru late October. The current grazing periods reflect a reduction of roughly 50 percent from the allowable periods of the past.

The treatment of range issues in the various Inyo NF planning documents has remained relatively consistent for the areas within the Mammoth to June Study Area. Grazing has always ranked lower than other resource values in the Study Area, when conflicts between resources would occur. In general, these conflicts have been avoided by range management staff, or unrecognized by other resources.

Very recently, however, the issue of sheep grazing in Glass Creek Meadow has become important due to the presence of Yosemite toads in the meadow. This toad species is in the midst of a presumably unprecedented and rather spectacular decline, with causes for the decline still uncertain. Sheep grazing is probably not beneficial, and more likely harmful, to the toads and informed members of the public and wildlife personnel are pressing for the elimination of domestic livestock from Glass Creek Meadow. Range management staff have responded by urging the permitee to spend more time in Yost Meadow and less time in Glass Creek Meadow. This has been a somewhat effective stopgap measure, while a more permanent solution is worked out.

By comparison with other issues in the Mammoth to June Study Area, grazing has received scant attention by both forest planning efforts and the interested public. It seems likely that issues such as the Yosemite toad/sheep grazing conflict in Glass Creek Meadow will stimulate interest in grazing in future planning efforts by the Inyo NF and in the public at large.

RECREATION HISTORY

Early recreation use of the study area was typically camping associated with hunting and fishing. Mammoth served as base area for many early excursions as early as 1904, when Langille noted the areas popularity as a summer resort in his report on potential additions to the Sierra Forest Reserves. The first developed areas were designated in the late 1920s Plat maps for the Crestview Resort and Glass Creek summer homes are dated 1929. The CCC's were based in the Shady Rest area during the 1930s, and development of campgrounds in the Hartley Springs and Glass Creek area are probably associated with CCC projects.

Recreation use and development was fairly static through the 1950s, although management plans recognized the recreation values of the area. Recreational use on other areas of the forest grew rapidly as roads and cars improved in quality.

In most instances the study area was considered an expansion zone for Mammoth Lakes. The picture changed rapidly with the introduction of winter sports into the area. Mammoth Mountain ski area was established in 1949 in the upper Dry Creek watershed with a portable rope tow, and has grown to be the largest single ski area in the country. The Forest Service approved the first warming hut in 1952, and the first chair lift in 1955.

The forest also added recreation facilities in the late 1950s, constructing Minaret Vista and the Deadman Creek campground. By the 1960s, recreation developments were expanding in several areas. Mammoth Mountain continued a steady expansion of lifts and runs, including the addition of a gondola. The Mammoth Mountain Inn was built in 1960, and the Mammoth Chalets were constructed through 1965. The forest built the Earthquake Fault Interpretative site, as well as expanding Shady Rest Campground and constructing Pine Glen Campground. The decade of the 60s was capped with the dedication of a new visitor center next to Shadey Rest in 1969.

Recreation development since the 1960s has been limited to Mammoth Mountain and the addition of a campground south of Glass Creek. Recreation use has changed significantly. The pressure for dispersed use has shifted from hunting and fishing to camping and driving for pleasure. Nordic skiing increased in popularity in the 70s, and has held steady since then. Snowmobiling and snowplay are growing uses in the 90s, and capacity does not meet the demand for either activity. Mountain Biking is the growing summer activity, and there is an increasing demand for single track trails.

ACKNOWLEDGMENTS

This appendix was written by: Dale Johnson, Silviculture, and Robert Hawkins, Ecosystem Management/Recreation, Inyo National Forest, Bishop, California.

APPENDIX 50.2

Summary of Records of Information, Winter 1995, Mammoth-June Landscape Analysis, Inyo National Forest

Team Member:
Date of Record: 3/23/95
Subject Area for Team: Fuels, Fire History

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):Finding fire intervals (fire history), existing fuels loads, stocking levels of conifer and brush species, finding the historical range of variability, what did this area look like before fire exclusion. By finding out fire intervals and all other items address, this information directs us towards our desired condition.
Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):
Fire history- Sample slabs from stumps and trees, historical records of fire occurrence.
Fuel loading- Using Brown's inventory to find out levels of fuel loading by class. May use photo series for some areas.

Maps? Maps showing fires of 10 acres or more. Not sure of dates. May have some of the fire history on GIS.

Vegetation

Documents?

Ongoing studies or surveys in the area? Only the fuels inventory.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions

What "ecological indicators" or other variables are you inventorying or mapping? Fire occurrence and size , fuel loadings, weather, topographic features, and riparian areas.

Progress? Expected completion date (be real):
Fire history is partially done, should be completed this summer.
Fuel inventories have been started and completed this summer.

What portions of M-J landscape are you focusing on? Why?
Sawmill bench area- Existing timber sale in this area that fuel treatment has started. Broadcast, jackpot, handpiles, understory burning. The rest of the landscape. We do not have good data at this time of fuel loadings, fire history etc. for the rest of this landscape.

BRIEF summary of what you've found to date:
The areas that have been sampled for fuel loadings have come up with loading of 12 ton/acre.

Found post activity fuels in decaying condition for treatment of lop and scatter. Date of activity fuels was sometime in the late 70's.
In some areas we have found encroachment of white fir in the Jeffrey Pine stands and white fir encroachment in the Red Fir stands.
Found no sign of large fire occurrence in the Red Fir area in recent years.

II. Historical Conditions

What historical conditions are you attempting to analyze?
Fire occurrence intervals, intensities, and sizes. Type of fire- was it a person caused fire or natural. Condition, age, and species of vegation. Role that fire played in this area.
Progress? Expected completion date:
Late summer or early fall. Have some info gathered but need to still do some field verification.
What portions of M-J are you focusing on? Why?
We are looking at the whole area. This give us better data for future projects

BRIEF summary of what you've found to date:
Found samples of fire history in the Sawmill bench area, fuel loadings in the same area. These samples are showing us that frequent low intensity fires at close intervals in the past and less frequent high intensity fire in present time.

III. Analysis

How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?
Yes. It would lead to finding the desired condition.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?
Yes. It will help establish the range of variability.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?
Intervals and intensities
Yes

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?
Strategies to obtain desired conditions.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: 3/23
Subject Area for Team: Fire History, Recreation

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):

What is the historic fire frequency and intensity? Fire was a primary disturbance factor and had a significant role in shaping vegetation composition and structure. Fire history will help define the historic landscape conditions as well as contributing to a description of desired condition.

What recreational opportunities exist in the area? What potential exists? What are the demands for recreation? These will support the development of a desired condition.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Fire History - Field survey in the fall of 94 in the Sawmill Salvage timber sale area. Forest inventory of fires from the 1960's to present, with maps of larger fires. Research findings for similar vegetation cover types available in my office.

Recreation - Several maps and reports that document recreation opportunities in the area, including potential developed sites. The Forest Plan also documents recreation opportunities based on the "ROS" system.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. <u>Existing Conditions</u>
What "ecological indicators" or other variables are you inventorying or mapping?

Recreation facilities and opportunities, recreation use levels

Progress? Expected completion date (be real):

Field work is complete, GIS input is in progress. Target date for completion is by mid May

What portions of M-J landscape are you focusing on? Why?

For this resource we are covering all the area

BRIEF summary of what you've found to date:

Facility development is relatively low. Most sites fit the roaded natural ROS class, however some private sector sites fit the urban ROS. Use of the area is heavy both winter and summer. Summer use is associated more with sites, winter use is more dispersed. Demand for mountain biking in the area has increased, and demand for single track trails is not being met by the available supply. Demand for winter snow play areas is also growing, and while terrain is available, safe parking or other services is not.

II. <u>Historical Conditions</u>
What historical conditions are you attempting to analyze?

Historic fire frequency and intensity

Progress? Expected completion date (be real):

Field work is complete, results will be combined with research findings to describe fire history by cover type. Descriptions will be done by the end of April.

What portions of M-J landscape are you focusing on? Why?

For the fire history, focus is on the Jeffrey pine and mixed conifer cover types, because fire suppression has altered the fire regime the most in these areas. The change in fire regime, combined with timber harvest, has resulted in considerable change in vegetation composition and structure. The consequences of these changes need to be considered in the discussion of desired condition.

Fire history in the sage brush is documented in several papers, and we don't have much in the study area. We have enough info to discuss desired condition.

Fire history is also well documented for the red fir cover type, and our area seems to fit the research findings. Fires occurred less frequently, so suppression of fires hasn't had the time to alter vegetation composition and structure. Most of our red fir has also not been logged. We have enough info now to determine the desired condition from a fire regime standpoint.

BRIEF summary of what you've found to date:

For the mixed conifer stands, fire occurred quite regularly until the turn of the century, and then less extensively through the 1950's. The fire interval on a stand basis (50-100 acres) ranges from 10 to 20 years.

Stands show a marked break in age classes, and preliminary work indicates that the break is tied to the last observed fire in the stand. One area examined had fires scars that indicated the last fire occurred around 1900, younger pines were 70-80 years old and fir were 60-70 years old. Stand basal area was in excess of 300 sq ft.

III. Analysis

How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?

Recreation - The existing recreation information should be used to help shape the desired condition after the resource thresholds have been estimated. Evaluating and incorporating the use of the area by people is critical to the desired condition.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?

Fire History - The fire history information is going to provide useful background on how the cover types were formed and how disturbance processes operated in the past. It will help us estimate how much the existing condition varies from the historic condition. It should provide an indication of what forest types are sustainable under different disturbance regimes.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?

The historic range of variability applies to this information, but the data from the survey only goes back to the early 1700's, so anything beyond that is extrapolation. The historic range of variability will be expressed as the average fire interval on a stand basis by cover type for various time periods. The information we have for two stands will be compared to the literature to extend the comparison.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

Sustainability would be the ability to maintain a dynamic mosaic of cover types and seral stages across the landscape. The vegetation would have to be able to cope with most disturbances without irreplaceable loss of a particular component. The mosaic is defined in a social context based on a combination of social and resource values. Human influence is integrated into the process, so that uses do not impair the ability to maintain the desired mix of ecosystem components.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: 3/24/95
Subject Area for Team: Plant Ecology

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):

"What is the current existing vegetation and its spatial distribution?"

Analysis of the information answering this question will be used in determining the desired future condition.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps?
Currently there are maps of the dominant/co-dominant vegetation developed from orthophoto quads, LMP data, timber data, that are housed in the M-J GIS data base. There is some wildlife habitat data that the Mammoth district has and the timber compartment data set housed at Lee Vining.
Documents?
Ongoing studies or surveys in the area?
For the above two questions contact Bob Hawkins and/or Connie Millar. They have been involved with fire history, paleoecology, and a Glass Creek watershed floristic study.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions
What "ecological indicators" or other variables are you inventorying or mapping?

Percent aerial cover of existing vegetation by lifeform and species.
Slopes
Aspect
Percent basal cover of total vegetation, duff, litter, bare ground/gravel/rock
Down woody debris and snags

Progress? Expected completion date (be real):

We have completed the field mapping and polygon verification of dominant vegetation for approximately a third of the M-J landscape area. We will be completing the analysis on that acreage and attempting to extrapolate to the other portions of the landscape using environmental data and the existing vegetation data sources mentioned above. 5/1

What portions of M-J landscape are you focusing on? Why?

The whole landscape.

BRIEF summary of what you've found to date:

Observations from the field notes:
PIJE and PICO seem not occur together with ABMA except as traces. They seem to follow the following gradient:

East--West
Lower elevation---------------------------------Higher elevations
PIJE--------------------PIJE/ABMA-------------ABMA
PICO--------------------PICO/ABMA-------------ABMA

At approximately 2600 meters ABMA became dominant over PIJE or PICO.
PICO occurs on a wider amplitude of moisture conditions then does PIJE appearing to be more abundant in the higher elevations and the pumice soil types.
ABMA was more dominant than ABCO.
PIJE-ABCO has a significant shrub diversity as compared to PIJE-ABMA (soil type differences?)
PIJE-PICO tree overstory had a low shrub cover component.
ABMA does not have a shrub component except as inclusions.
Only pure sizable stand of ABCO was found on the north facing slopes above June Lake. Mammoth Mtn area was the next area of high occurrence but mixed with PIJE.
ABCO shrub understory was found to be very diverse.
PIJE seemed to be the dominant in areas of ABMA harvest.
Mainly seeing PUGL2 in understory of PIJE stands but PUTR was associated with ARTR2 stands.

PIJE- Jeffrey Pine; PICO- Lodgepole; ABMA- Red Fir; ABCO- White Fir; PUGL2/PUTR- Bitterbrush varieties; ARTR2- Sagebrush.

II. Historical Conditions

What historical conditions are you attempting to analyze?

I will be using input from other team members in the future, especially harvest information which has played a role in determining the existing vegetation.

Progress? Expected completion date:
What portions of M-J are you focusing on? Why?
BRIEF summary of what you've found to date:

III. Analysis

How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?

In developing the desired future condition.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?

In developing the historic site potentials.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?

I anticipate, if the information is there, to describe the natural range of variability for vegetation on the basis of current site potentials.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

A synergistic complex of plants, animals and cultural components whose structures and processes can be maintained indefinitely.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: MARCH 2, 1995
Subject Area for Team: SILVICULTURE

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):
1. What was the historical condition of the conifer forest?
2. What is the current condition of the conifer forest?
3. What were the process that shaped the historical condition and what processes or lack of processes have shaped the current condition?
4. What is the natural range of variability for the Forest types?

Knowledge of Forest structure both historic and current as well as what structures (ecosystems) are potential and sustainable integrates directly with all other resources and tends to dictate long term sustainable desired conditions for all other resources.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Information available to me includes Don Potter's work on red fir and Jeffrey pine. CIA data for the earthquake and deer mountain compartments, old sale data and recent stand exam data for Dry Creek, Hartley and Glass compartments.
Some of this info is on GIS also Ralph Warbington's remote sensing data is on GIS.
Ongoing studies include pine marten surveys and analysis of deer hiding cover.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions

What "ecological indicators" or other variables are you inventorying or mapping?
Ecological indicators include species mix, stand structure, density, range of age/size classes, susceptibility to minor and major disturbances.

Progress? Expected completion date (be real):
I have completed the current and historic condition of Jeffrey pine, working on Red fir and lodgepole pine. Expect to finish in sometime in June.

What portions of M-J landscape are you focusing on? Why?
I have been focusing on the Jeffrey pine forest and the true fir belt below San Joaquin ridge since I have data on those areas.

BRIEF summary of what you've found to date:
Due to years of timber harvesting and fire suppression the Jeffrey pine forest no longer resembles its historic condition and is more susceptible to major disturbance from fire, pathogens and insects than ever before. However, additional thins and prescribe fire could return it to its natural range of variability within 10 to 20 years. The red fir/lodgepole pine ecosystem is eliciting some interesting info and potential hypothesis in my mind. Frequently the lodgepole is relatively young and has scattered fir and/or pine overstory. The overstory is frequently 200 to 400 years of age. This suggests to me that stand replace fires (or some other disturbance has occurred) and the lodgepole has invaded and now fir has seeded in under the lodgepole. In another 100 years may convert to fir. Also there are fewer large trees per acre in the red fir than I would have expected.

II. Historical Conditions

What historical conditions are you attempting to analyze?
I am attempting to describe historical conditions for the major cover types ie Jeffrey pine, mixed conifer, red fir and lodgepole pine.

Progress? Expected completion date: See above.

What portions of M-J are you focusing on? Why? See above.

BRIEF summary of what you've found to date: See above.

III. Analysis

How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?

Existing conditions should provide the land manager a benchmark from which to determine if the landscape is within its desired condition, and provide a basis from which to generate projects that push the landscape to or maintain it at it desired condition.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?

Information on historic conditions should provide us a basis for determining if the rationale behind our ecological indicators is valid and a basis for determining if current and proposed desired conditions are sustainable.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?

I expect to describe the natural range of variability in terms of forest structure, species mix etc, as well as the processes and disturbances that have molded the landscape into a sustainable ecosystem.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

Ecological sustainability is the ability of the desired condition to maintain and replicated itself over a long period of time, ie 100s of years. It does not mean that the historic condition is replicated nor are all species and or conditions managed for.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: 3/14/95
Subject Area for Team: Fisheries/aquatics

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):

What is the makeup of the fish population, the condition of the stream habitat, and what factors (human and other) brought the existing condition to its present state?? How will this information help in the analysis of determining the DFC?? Where is the potential amphibian habitat, how do present populations compare to other populations regarded as healthy, and how much has existing occupied habitat and its populations been affected by recent, historical management activities?? Not sure how it will assist the overall M-J analysis yet.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps?
I have found no maps pertaining to aquatic species for the M-J area yet. The springs in the area have been mapped by the hydrologic technician in the Bishop Office, and I plan to have the amphibian crew use this as part of the M-J frog/toad survey this summer.

Documents? None located yet.

Ongoing studies or surveys in the area? The Forest has stream survey data for Glass and Deadman Creeks, and some cursory data concerning Yosemite toads in Glass Creek Meadows. I plan to survey most or all likely habitat for Yosemite toads and mountain yellow-legged frogs in the M-June Analysis Area this summer. I plan to have the stream survey data entered into our PC database this spring, and analyze the data shortly thereafter to see if/how it can be used for development of DFC's.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

Literature search and review is complete to the best of our knowledge. Stream habitat data has been collected, but not completely analyzed. Fish distribution surveys are essentially complete for Glass Creek, but stage of completion is unknown for Deadman Creek; however, there may be enough data for a meaningful analysis. I will not know if amphibians can or should be used in the analysis until July-August (after some field work is done).

I. Existing Conditions

What "ecological indicators" or other variables are you inventorying or mapping?

Fisheries
% coverage of pool area by fine sediment
% cobble embeddedness
amount of pool habitat (pools/100 meters)
large woody debris (pieces/1000 meters)
biomass (kg/hectare)
distribution of different trout species throughout Glass Creek and possibly Deadman Creek
any available macroinvertebrate data

Amphibians
Habitat availability
Habitat distribution
Metapopulation pattern

I plan to work with the hydrologist on water quality and hydrology DFC's

Progress? Expected completion date (be real): 6/15/95 or soon after our Range Allotment EA's are done. If amphibians are used in the analysis, it will be late August-early Sept. If this is too late for use by the team, amphibians will have to be dropped.

What portions of M-J landscape are you focusing on? Why?

I am focusing mostly on Glass Creek and surrounding meadow areas because that is where I have the most data and it is where the only known amphibian populations exist in M-J.

BRIEF summary of what you've found to date:

Glass Creek supports a tremendous population of wild brook and brown trout and displays other signs indicative of a highly productive stream. The stream contains very low amounts of large woody debris that appears to be a natural condition. A complete barrier to upstream fish movement exists approximately 1200 meters downstream of Glass Creek Meadows. Large numbers of Yosemite toadlets were found in Glass Creek Meadows in 1993. Roads were built too close to the stream channel on parts of Deadman Creek and may be limiting the natural hydrologic conditions to some degree.

II. Historical Conditions

What historical conditions are you attempting to analyze?
Fish distribution and possible affects to amphibians

Progress? Expected completion date:
6/15/95

What portions of M-J are you focusing on? Why?
Glass Creek due to data availability and the highest amount of amphibian habitat found in the analysis are to date.

BRIEF summary of what you've found to date:
Have just started investigating historical conditions and availability of this type of data and have no concrete findings yet.

III. Analysis

How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?
I think it should be used in a comparative role to approximate how much the ecosystem is being controlled or influenced by primarily human processes vs natural processes. In other words, are past or present human activities (management or general public use) the dominant forces driving the M-J ecosystem, or are natural ecosystem functions the dominant forces.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?
I don't have enough information yet to answer this.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?
It would be meaningful, but I'm not sure enough data can be collected with the current deadlines to be able to determine natural ranges of variability for some of the aquatic species and their habitat.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

A watershed in a condition that allows the natural fluvial processes of the stream channel determine the habitat condition and populations of aquatic organisms. In this way, the carrying capacity of aquatic organisms would be set by the natural potential of the stream ecosystem.

I would like to compare habitat characteristics in reaches above and below disturbed areas and attempt to get an idea of the health of the systems (Glass and Deadman Creeks). If the data allow this, I can probably approximate DFC's for various EI's in the disturbed and undisturbed reaches. I have so little data on amphibians and their habitat in M-J, I'm not sure I can develop anything accurate for amphibians beyond an approximation of unoccupied habitat, and a comparison of unoccupied habitat available now vs historically.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: 3/23/95
Subject Area for Team: Water (air)

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):

How much water is available for diversion in the project area?
Define existing conditions, past and current human-caused impacts.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps? Geological maps, maps created for project
Documents? Ken Heim's 1993 survey
Ongoing studies? None, except those related to geothermal developments, and our own studies.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions
What "ecological indicators" or other variables are you inventorying or mapping?

--water quality parameters: pH, conductivity, temperature, DO
--snowpack water content, stream flow
--spring locations, flow
--channel morphology with cross sections
--watershed improvement needs and conditions

Progress? Expected completion date (be real):
Ongoing

What portions of M-J landscape are you focusing on? Why?

Deadman and Glass Creeks, focusing on these as the primary flows in the watershed (ignoring Mammoth Creek watershed)

BRIEF summary of what you've found to date:

Overall, the watershed is in good condition. Impacts are localized (campsites, roads). The water quality in the project area is excellent with the exception of brief episodes of elevated sediments during the snowmelt period. There are many springs in the area providing high quality wetland habitat.

II. Historical Conditions
What historical conditions are you attempting to analyze?

None, with the exception of Glass Creek Meadow watershed condition.

Air quality: qualitative discussion of standard air quality parameters.

Progress? Expected completion date (be real):
What portions of M-J landscape are you focusing on? Why?

BRIEF summary of what you've found to date:

III. Analysis
How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?

Existing and historic conditions should help us develop DFC. Specifically, a general water balance will help us determine the reference (NRV) variability to provide the recommended management variability.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?

Water flows: quantitative
Air quality: qualitative

Could also include water quality and channel morphology.

The concept is meaningful here, because future development relies on water availability, and NRVs assist to determine how much water is available.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

Critical. We need to insure that the land uses allowed in the project area sustain the current aquatic, riparian, and groundwater dependent ecosystem components, structures, and processes.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: April 3, 1995
Subject Area for Team: Geology

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):

Uncertain how to answer this question. The question implies that I am doing studies or inventories. To this point all I have done is input existing data. I believe this data will identify the existing geologic condition in the area and provide a baseline for analyzing impacts from and imposing constraints to future uses proposed within the study area.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps?
Geologic map of the Long Valley Caldera, Mono-Inyo Craters Volcanic Chain, and Vicinity, Eastern California, Bailey, Roy A., U.S. Geological Survey, Miscellaneous Investigations Series, 1989.
(Principal source of bedrock geology).

Documents?
Geologic Resource Inventory, and Evaluation of Landslide, Seismic, and Volcanic Hazards in the Inyo National Forest, Merrill and Seeley, Inc. Contract No. 53-9JC9-0-50, For the Inyo National Forest, May 1981. (Source of geologic hazard information).

Basement Structure Implication for Hydrothermal Circulation Patterns in the Western Moat of Long Valley Caldera, California, Sumnicht, Gene A. and Varga, Robery J. Journal of Geophysical Research, Vol. 93, No. B11, Pages 13,191-13,207, November 10, 1988. (I used one of the maps as a source of fault locations in the central portion of the M-J area).

Geothermal Leases issued during 1980 and 1984 contain the lease boundaries. The Environmental documents written to document the affects from leasing contain the surface and seasonal occupancy restrictions on those leases. (Sources for the geothermal lease area boundaries and use restrictions).

Hundreds of other article and publications which include all or portions of the Mammoth to June area are on file at the Inyo National Forest office in Bishop and are available for review but were not used as primary sources of information.

Ongoing studies or surveys in the area?

Ongoing monitoring of seismicity and ground deformation within the Long Valley Caldera by U.S.G.S personnel from Menlo Park, California.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions

What "ecological indicators" or other variables are you inventorying or mapping? None. Current data input entirely from existing data sources. These consist of bedrock geology, seismic, volcanic, and landslide hazards, fault locations, and existing geothermal lease areas and surface use restrictions associated with each lease.

Progress? Expected completion date (be real): April 30, 1995. Currently 90% complete.

What portions of M-J landscape are you focusing on? Why? Not focusing on any specific portion of the M-J landscape.

BRIEF summary of what you've found to date: No answer to question.

II. <u>Historical Conditions</u>
What historical conditions are you attempting to analyze? None

Progress? Expected completion date:
What portions of M-J are you focusing on? Why? None
BRIEF summary of what you've found to date:

III. Analysis
How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?
Unknown

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?
Unknown

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?
Unknown

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis? Little meaning

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: 3/15/95
Subject Area for Team: Wildlife Biologist

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?): 1)Marten and other forest carnivores habitat use parameters
2)Spotted Owl-determine occupancy based on habitat interface between east-side pine and red fir (easterly expansion "line")
3)Goshawk-population density/estimate
4)willow flycatcher and 5)Yosemite toad-Glass Creek inventories
6)Breeding bird inventory

This biological information will provide baseline data from which to measure our progress toward a desired condition. Establish habitat parameters for sustaining viability of key species (mature habitat components, riparian integrity, bird communities, etc.)

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps? Survey strategy maps
Documents? forest carnivore study proposal
Ongoing studies or surveys in the area? multiple

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions
What "ecological indicators" or other variables are you inventorying or mapping?
See above

Progress? Expected completion date (be real):
August 31, 1995

What portions of M-J landscape are you focusing on? Why?
Timbered and riparian
Habitat for indicator species
BRIEF summary of what you've found to date:

Forest carnivores- marten in red fir, Jeffrey Pine/white fir (habitat parameters in progress)

Spotted Owl- confirmed sightings in red fir; potential habitat mapped and surveys ongoing

Goshawk- nest sites in red fir and east-side pine

Willow flycatcher- habitat survey completed

Yosemite toad- occupancy established, population estimate to be completed

Breeding bird survey-to be developed

II. Historical Conditions
What historical conditions are you attempting to analyze?

Level of sustainability for indicators species

Progress? Expected completion date:
Unknown

What portions of M-J are you focusing on? Why?

Red fir mature habitat
Riparian areas
1) Provides greatest potential for historical conditions analysis
2) Habitat is high quality, therefore provides greater opportunity for data collection and resulting development of habitat parameters

BRIEF summary of what you've found to date:
In progress

III. Analysis
How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?

Provide for goals and objectives in order to provide for species viability

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?

Future planning

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

Providing for continued existence of indicator species and habitat

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: 3/20/95
Subject Area for Team: Visual Resources

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):

What is the visual quality, condition, sensitivity, and absorption capability for the M-J area. From where and to what degree is the M-J area seen from key viewing platforms. What will be the visual impacts of various management alternatives and resource modifications. Will the selected management prescription meet the visual objectives identified in the Inyo Land and Resource Management Plan.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps? Inventory Maps for all inventoried visual data is located in the flat files in the Xerox room of the SO. Maps showing seen area, variety class, sensitivity levels, inventoried VQO's, visual absorption capability, and existing visual condition are available. This info is being entered into the GIS format for M-J.

Documents? Visual direction is located in the Forest Plan and the Mono Basin CMP. The old Visual resource handbook (big-eye book, etc.) is being replaced by a new Scenic Resource handbook this fiscal year. A draft is in my office.

Ongoing studies or surveys in the area? Not at the current time.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

I. Existing Conditions

What "ecological indicators" or other variables are you inventorying or mapping?

At this time I am not inventorying any other information other than what we already have. We make occasional corrections from time to time, as conditions change, particularly viewpoints as roads or trails change or are added.

Progress? Expected completion date (be real):

Inventory and information basically completed. Terminology and language may change when the new handbook is finished.

What portions of M-J landscape are you focusing on? Why?

The visual resources are focused on the whole area. However any impacts relating to the steep escarpment lands, such as the Knolls, San Joaquin Ridge, and Whitwing will be especially critical because of their high visibility from everywhere.

BRIEF summary of what you've found to date:
Being the only major forest area between LA and Reno the M-J area provides a landscape that receives close scrutiny. The combination of timber and broad views and landscapes with high mountains and ridges provides for exciting scenery. The timber in this area also provides excellent screening ability for a large variety of impacts. Susceptible to visual disturbances are the steep slope areas and ridges mentioned above.

II. Historical Conditions

What historical conditions are you attempting to analyze?
At this time none other than existing visual condition which maps areas of disturbance and the degree of disturbance.

Progress? Expected completion date:
done.
What portions of M-J are you focusing on? Why?
The total area. Every acre has visual significance and every acre is managed with an assigned VQO through the Forest Plan.

BRIEF summary of what you've found to date:
Major Disturbances have been created by the Hwy 395 corridor and are related to this corridor. Most other areas within the M-J area have received relatively minor disturbances that are visible or none at all. Most of the area is seen as a natural appearing landscape to most viewers.

III. Analysis
How do you think the info or data you are collecting on existing conditions will or should be used in the overall analysis?
The existing visual condition can be used to determine the amount of visual change will take place under various management alternatives and with the selected alternative, if any.

How do you think the info or data you are collecting on historical conditions will or should be used in the overall analysis?
See previous answer.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?
Don't think so.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?
I'm not sure yet. Any scenario that is ecologically sustainable will probably not change the quality of the scenic resource to any noticeable degree.

RECORD OF INFORMATION, WINTER 1995
MAMMOTH-JUNE LANDSCAPE ANALYSIS
Inyo National Forest

Team Member:
Date of Record: Mar. 17, 1995
Subject Area for Team: Paleoecology, archaeology

Key Questions for your Subject Area (i.e., what questions are guiding the studies/inventories you are doing, and how do they support the overall analysis?):
Paleoecology:
1. To what extent can a Late Glacial/Holocene landscape history be compiled from existing and planned data bases, for both the analysis area and the regional context?

2. Assuming the vegetation record will provide the most complete and continuous chronology and because vegetation integrates many ecological variables (i.e., hydrologic variation, soil development, substrate control, geomorphic processes) and can act as a proxy for environmental conditions, a series of related questions can be asked: what has been the pattern of vegetation dynamics through time; what were the trends and periodicities in vegetation composition; what were the rates of change; what have been the autogenic and allogenic successional trends and pathways; what have been the major disturbance regimes and at what frequency have they occurred; how has vegetation responded to climate change, and have the responses been in equilibrium with climate or not?

Archaeology
1. In general, what have been the patterns and trends of human land use since initial occupation of the analysis area; what is the history of human adaptation in terms of settlement/transhumance patterns, economic systems, technologies, and resource bases?

2. How have exchange networks evolved and what have been their relationships to local economic systems and broader interaction spheres?

3. What has been the response of human populations to environmental variation and, conversely, how and to what extent have human populations affected the environment?

Relation to the analysis:
Paleoecological and archaeological information will contribute to the description of the historic condition. It will define historic trends and ranges of variability and help to assess the stability and resilience of ecosystems and the status of the existing condition. This is essential for predicting the success of achieving the desired condition.

Information Available about M-J Area for your Subject Area (include citation and a brief description of each; if there are many references, give general description, and where the info can be found):

Maps? Archaeological sites are plotted on Heritage Resource Atlases (7.5' and 15' Quads) filed in the Lee Vining and Bishop offices. Site locations within the M/J analysis area have been entered in the Forest GIS system.

Documents? The nearest paleoecological sites (pollen and macrofossils), Starkweather Pond and Barrett Lake, along with other, more distant Sierra Nevada sites, have been published by Scott Anderson in Journal of Ecology 78:470-489 (1990). Pleistocene glacial geology of the Mammoth Lakes area has been summarized by R. R. Curry in University of Montana Department of Geology, Geological Serial Publication 11 (1971). Late Pleistocene glacial geology of Mono Basin (including the north end of the M/J analysis area) is summarized by M. Bursik and A. Gillespie in Quaternary Research 39:24-35 (1993). Holocene climatic and glacial history is presented by R. R. Curry in Geological Society of America Special Paper 123 (1969). Holocene volcanism of the Inyo Craters is discussed by C. Miller in Geology 13:14-17 (1985) and by D. E. Sampson and K. L. Cameron in Journal of Geophysical Research 92(B10) (1987). Research on the Holocene volcanism of the Mono Craters is presented by K. Sieh and M. Bursik in Journal of Geophysical Research 91:12,539-12,571 (1986). The overall geology of the Mount Morrison Quadrangle is summarized by C. D. Rinehart and D. C. Ross in U.S. Geological Survey Professional Paper 385:1-106 (1964). There are numerous published and unpublished reports on the archaeology of the area, both surveys and data recovery projects. This gray literature has been generated under contract with the Forest Service, Bureau of Land Management, CalTrans, and private developers. All reports are on file at the Bishop and Lee Vining Offices, Inyo National Forest.

Ongoing studies or surveys in the area? None that I know of.

TEAM ASSIGNMENT AND PROGRESS (i.e., your assignment & your progress)

My assignment is, with other team members, to inventory and analyze the historic condition. To date, all archaeological and paleoenvironmental documents have been compiled and read. A short sediment core for pollen, macrofossil and charcoal analysis has been retrieved from Glass Creek Meadow and is in cold storage, awaiting processing. Cross-sections of logs from the Whitewing Mountain "ghost forest" are undergoing analysis, in collaboration with Connie Millar of PSW; included is taxon identification, tree-ring dating, and radiocarbon dating. Cross-dating using skeleton plots was unsuccessful and so direct measurement with computer plotting is planned.

I. Existing Conditions

What "ecological indicators" or other variables are you inventorying or mapping? The only indicator relevant to my analysis is fire frequency (see historic condition for details).

Progress? Expected completion date (be real):

What portions of M-J landscape are you focusing on? Why?

BRIEF summary of what you've found to date:

II. Historical Conditions

What historical conditions are you attempting to analyze? Prehistoric vegetation, volcanic, tectonic, glacial, fire, and cultural history since the last glacial maximum (18,000 years). See above for details.

Progress? Expected completion date: Sept. 1995.

What portions of M-J are you focusing on? Why? The entire project area for cultural, volcanic, tectonic, and glacial history since archaeological sites, tephra, faulting, and glacial till and moraines are located throughout; Glass Creek Meadow for the pollen and charcoal (fire) record although the record (among the other pollen and macrofossil records) ranges from local to regional in extent.

BRIEF summary of what you've found to date: Even a summary of the data base to date is too extensive for this questionnaire, but I'll send it if you want.

III. Analysis

How do you think the info or data you are collecting on historic conditions will or should be used in the overall analysis?

The prehistoric data should help define the temporal range of variability of ecosystem processes in the study area and place the present condition of the ecosystems along their temporal trajectories. Data on prehistoric conditions and trends will provide comparative information to assess the extent of ecosystem modification by historic and present management practices. Reconstruction of past disturbance regimes (fire and volcanism) will contribute to knowledge about the resilience and thresholds of M/J ecosystems as reflected in the vegetation (pollen) record.

How do you anticipate describing natural ranges of variability for the data you are collecting? Is this concept meaningful to your part of the M-J analysis?

1. Temporal ranges of variability in vegetation patterns (abundances of taxa and composition of plant communities relative to disturbances, climate change, and internal biotic dynamics) will be described by analyzing pollen profiles using numerical methods (such as Spearman's rank correlation coefficient, principal components analysis, and cluster analysis) for comparing stratigraphic sequences. Baseline pollen representation of past vegetation will be estimated using a dissimilarity coefficient (probably squared chord distance) to identify modern analogs for pollen spectra.

2. Rates of vegetation change will be determined by the analysis of pollen percentage data using the ordination technique of Detrended Correspondance Analysis.

3. An attempt to relate pollen spectra to climatic variables for a paleoclimatic chronology will be made using ecological response surfaces as a transfer function.

4. Large and small particle charcoal accumulation rates, correlated with fire scar chronologies, will be used to estimate variation in fire frequencies (intervals).

The concept of natural ranges of variability has a central place in my analysis.

What does "ecological sustainability" mean in the context of your contribution to the M-J landscape analysis?

Sustainability is relative to the management objective for an ecosystem. If the objective is a complete transformation or destruction of an ecosystem, then sustainability is meaningless. If minimal disturbance to or protection of an ecosystem is a management objective, then paleoecological information is necessary for determining the thresholds within which ecological processes can be maintained, not to sustain the function or structure of an ecosystem indefinitely, since that is contrary to the nature of ecosystem dynamics, but to sustain the operation of those processes to allow its evolution relative to ongoing contextual trends (including external human influences).

Draft Desired Condition for the Mammoth to June Analysis Area

INTRODUCTION

This document is the second of three reports that will be developed by the Mammoth to June analysis team. It describes the proposed Desired Condition for the Mammoth to June analysis area. This description was prepared by the Inyo National Forest line officers and analysis team members. This proposed Desired Condition will be distributed to the public for review and comment. The analysis team and line officers will review the comments before releasing the final version of the Desired Condition.

The Desired Condition is an integrated description of how we want our analysis area to exist, now and into the future. We have developed desired conditions for the landscape as a whole, and for specific geographic areas within the landscape. At each scale, the desired condition will address the blend of social, physical, and biological conditions that we would like to see in the area.

DEVELOPMENT OF THE DESIRED CONDITION

The desired condition is based on several sources of information, including the LMP, our understanding of the resource capabilities, and the comments from the public. The LMP provides the basic framework for minimum resource conditions, as well as providing direction for land allocations. Included with the LMP are current decisions that have committed the Forest Service to specific desired conditions within the analysis area. Some key decisions include the geothermal leases in the area, existing permits, public utilities and roads, the approved Master Development Plan for Mammoth and June Ski Resorts, the Shady Rest Community Park development plan, and the Glass Creek campground rehab project. Even with these sideboards, the LMP provides enough inherent flexibility to develop a desired condition that is based on the principles of ecosystem management.

The Existing and Historic Conditions report summarized our understanding of landscape components, structure and process. While we recognize that we did not document every facet of the analysis area, the report provides specific information for many key elements. This information was used to identify the variability within each element, as well as processes that currently operate or have operated within the landscape. Past and present structural components were also identified. Considered together, this information helped the team identify resource conditions that could be sustained over time.

The public comments provided proposed desired conditions from groups and individuals, as well as indicating key areas of interest. We collected comments from over 40 individuals at our August 17 public meeting, as well as receiving over 90 letters about the desired condition. The desired conditions expressed by the public covered a wide range of social settings, ecosystem processes, and structural elements. Some common areas of interest included the red fir vegetation series and the area around Glass Creek meadow.

The team took this information and worked with the line officers to develop an integrated description of the Desired Condition. The process was conducted in a series of meetings over several days. The focus was on identifying ranges of ecosystem elements that were compatible. The results are presented in the following sections. Some aspects of the proposed Desired Condition represent a change from the condition identified in the LMP. When this is the case, the LMP will need to be amended before we can implement that aspect of the desired condition. The amendment process will follow the requirements of the National Forest Management Act as well as the National Environmental Policy Act.

The Desired Condition is written in the present tense to represent landscape conditions after implementation of the LMP.

DESIRED CONDITION FOR THE MAMMOTH TO JUNE ANALYSIS AREA

The Mammoth to June landscape encompasses 36,000 acres of National Forest land between the Town of Mammoth Lakes and the community of June Lake. The area is bounded to the east by Highway 395, and to the west by the Ansel Adams wilderness. This area is considered the headwaters of the Owens River.

The Desired Condition is organized in two sections, the first is the overall Desired Condition at the landscape scale, and the second is a description of Desired Conditions for specific, smaller areas within the landscape. Although the analysis team recognized the interdependence between many of the elements, the landscape descriptions are divided into physical, biological, and social elements for organizational purposes and clarity. The Desired Condition for vegetation provided the best opportunity to consider the interaction for several elements, and as a result, the Desired Condition for fire, soils, and wildlife habitat will be discussed in that section.

Physical Elements

Geology. The scientific integrity of the volcanic features in the White Wing and Obsidian flow area is maintained.

Watershed: Overall watershed condition is very good. Riparian vegetation functions to filter sediment and provide bank stability; the uplands, wetlands, and streambanks function to allow water storage during high flow with releases during the rest of the year to sustain stream flow; and the channel and associated floodplains transport the high flows without accelerated erosion or accelerated alterations of channel morphology. Streamflow timing and magnitude for Glass Creek and Deadman Creek, as well as the springs in those watersheds, reflect climatic input from precipitation and snowmelt. Dry Creek flow regimes fluctuate in response to erosion and runoff control practices at the Mammoth Mountain Ski Area. Water releases from the ski area are regulated to avoid accelerated erosion of the Dry Creek stream channel.

The interaction between surface flows and groundwater is recognized. Groundwater resources are used to support consumptive uses of water, but extraction does not adversely impact beneficial uses that depend on base flow levels that are sustained by groundwater.

Water quality parameters are within the legal limits as defined by the Regional Water Quality Control Board and described in the Basin Plan for the Owens River. Stream turbidity, temperature, conductivity, and pH falls within the bounds described in the following table:

Component	Upper Owens River	Deadman and Glass Creeks	Dry Creek
Turbidity (JTU's)	0–15	0–15	0–100 ave.=15
Temp C	0–20	0–20	0–20
Conductivity (umh)	30–180	20–60	20–250
pH	6.2–7.5	6.2–7.5	6.2–7.5

There is no evidence of the introduction of human waste into the surface waters of the area.

Soils. Soil loss does not exceed the rate of soil formation (approximately the long-term average of 1 ton/acre/year). Areas with a high or very high erosion hazard are managed to minimize soil loss. Infiltration rates are high.

Volcanic soils have low bulk density, are readily permeable, and have high infiltration rates. Soil porosity (measured as bulk density) in vegetated areas is at least 90 percent of the total porosity found under undisturbed conditions.

Surface bulk densities of upland pumice soils within the area range from approximately .85 gm/cm3 to 1.10 gm/cm3. Subsoil bulk densities range from approximately 1.25 gm/cm3 to 1.58 gm/cm3. Soils forming in granitic or metamorphic parent materials tend to have slightly higher bulk densities. Soil compaction areas are limited to those sites designated for intensive use, such as roads, trails, and developed recreation sites. Temporary use sites that result in soil compaction are treated to reduce compaction.

The amount of organic matter in the soil varies depending on the vegetation series. The Desired Condition for vegetation describes this component of soils.

Air Quality. Air quality is within all legal standards, and activities that affect air quality are in compliance with the State Implementation Plans for the Mammoth Lakes and Mono Basin nonattainment areas. Air quality and visibility are usually outstanding. Smoke from vegetation fires may be present during certain times of the year, reducing visibility.

Fire and Fuels. Fire operates as a process throughout the landscape to provide nutrient cycling, fuel reduction, and vegetation succession. The degree to which fire occurs will vary by vegetation type, as detailed in the Desired Condition for vegetation.

The Town of Mammoth Lakes, Mammoth and June Mountain ski areas, the community of June Lake, and the Glass Creek recreation area are protected from high intensity fires that might occur within the area, and the landscape is protected form fires that might originate in these areas of concentrated use. The risk of fire spread is reduced by decreasing ladder fuels around these areas, by reducing fuel loads to less than 20 tons per acre, and by evenly spacing tree crowns in adjacent area so that contact between crowns does not occur.

The risk of large, high intensity fires within the landscape is low. Lightning caused fires may be managed using Prescribed Natural Fire plans, or one of the three fire suppression strategies (confine, contain, control). Human caused wildfires will be suppressed in the most cost effective manner, with cost being defined as suppression cost plus net value change.

Biological Environment

Vegetation. The vegetation across the landscape represents a complex mosaic of vegetation series. The relative occurrence or distribution of vegetation series changes little over time, and any large scale changes are in response to climatic changes and not human activities. The structure, species distribution, and size of individual plants will change over time as plant communities respond to processes operating within the landscape.

The Desired Condition for vegetation includes descriptions for species composition, vegetative cover, size class, snags (standing dead trees >12" diameter and >20' tall), logs (downed trees >12 diameter and >20' long), fire frequency, fire intensity, fuel loading, and surface cover. These descriptions apply to the overall condition within the vegetation series. Vegetation conditions for a specific area may vary from the range of conditions described for the series as a whole so that other desired conditions can be achieved.

Subalpine Series

This series is characterized by dispersed stands and scattered individual trees over rocky and often steeply sloping terrain. The common species are: whitebark pine, lodgepole, limber pine, western white pine, mountain hemlock, and western juniper. Shrubby thickets of aspen may be found on moist talus slopes. Shrubs and herbaceous vegetation are found throughout the high elevation rocky slopes. A significant number of springs and associated vegetation are also found throughout this zone and are important contributors to the biodiversity of this area.

Fire occurs relatively infrequently in this zone, and fire size is small, sometimes limited to a single tree.

Red Fir Series

The Red Fir Ecosystem comprises much of the western 1/3 to 1/2 of the study area. While red fir is the dominant tree species throughout this area, it is commonly associated with lodgepole pine, Jeffrey pine, western white pine, whitebark pine, white fir and mountain hemlock.

The desired vegetation community types can be grouped into two Red Fir Subseries: Red Fir with a Lodgepole component and Red Fir with a Jeffrey Pine Component. The red fir/lodgepole component is the dominant community type and is found throughout the Red Fir ecosystem. The red fir/Jeffrey pine community is typically found on southern exposures and lower elevations within the Red Fir Ecosystem.

Red Fir/Lodgepole Subseries. The area will display a mix of pure red fir community types with tree canopy closures of 60% or greater and red fir/lodgepole community types with tree canopy closures of 30-60%. While red fir is expected to be the dominate tree species, disturbance processes will create small to large openings (greater than 10 acres) in which lodgepole pine will dominate for periods of time. When lodgepole is dominate average tree canopy closure is expected to be lower and the larger size classes will account for a smaller percentage of the total cover. Without major disturbances, lodgepole pine might drop out entirely leaving communities comprised of red fir and mountain hemlock. High density, multi-layer stands will be the norm in those areas.

Common associates are western white pine and white fir on southern exposures and lower elevations and mountain hemlock and white bark pine at higher elevations and/or northern exposures.

The shrub and herbaceous understory will typically be less than 1%.

The tree canopy cover for these red fir community types is expected to be 60% or greater, unless lodgepole pine dominates in which case the canopy cover may be 30% or less. The mix of size classes over red fir community types will be:

Size Class DBH	Percent of Total Tree Cover
1-6"	3–7%
6-11"	3–7%
11-18"	5–9%
18-25"	5–9%
25-30"	5–9%
30-40"	15–35%
40"+	20–40%

The snag component is typically 3 to 8 snags per acre, 10 to 15 logs per acre contribute to the down woody debris, and the duff thickness is approximately 3" covering greater than 85% of the ground. Bare ground is less than 5%.

Fire operates as a process throughout this vegetation series. The range of fire indicators are:

Size	Intensity	Frequency	Fuel Load
0–2 Acres	Low	25–50 years	30–60 tons/acre
0–50 Acres	Mod–High	75–100 years	30–60 tons/acre

Red Fir/Jeffrey Pine Subseries. This subseries was divided into two groups as a result of site quality. The desired condition is described for areas of high site quality and areas of low site quality.

The sites of higher quality typically have tree canopy closures of 30-60% and lower site quality typically have tree canopy closures of 10 to 20%, with Jeffrey Pine comprising approximately 10-20% of the stand on both sites. A trace of lodgepole (less than 1%) may occur. The shrub and herbaceous components are typically less than 5%. The mix of size classes will be similar on both high and low sites with only the tree canopy cover differing and will be as follows:

Size Class DBH	Percent of Total Tree Cover
1–6"	3–7%
6–11"	3–7%
11–18"	5–9%
18–25"	5–9%
25–30"	5–9%
30–40"	15–35%
40"+	20–40%

Canopy cover will reach its maximum in areas dominated by the larger size classes. Areas occupied by smaller size classes will have correspondingly lower tree canopy closure.

The snag component is typically 3 to 5 snags per acre, 8 to 12 logs per acre contribute to the down woody debris, and the duff thickness is approximately 2-3" covering 50-85% of the ground. Bare ground is less than 5%.

Fire occurrence is similar to the Red Fir Lodgepole series, however, fire frequency is higher and fuel loadings slightly lower due to the southern aspects or lower elevations that this series occupies.

Size	Intensity	Frequency	Fuel Load
0–5 acres	Low	20–30 years	20–50 tons/acre
0–50 acres	Mod-High	75–100 years	30–60 tons/acre

Mixed Conifer Series

This series was divided into three groups as a result of site quality. The Desired Condition is described for areas of high site quality, areas of high site quality but modified by higher elevations, and areas of low site quality.

The sites of higher quality typically have tree canopy closures of 30-45%. Jeffrey Pine is dominant and white fir comprises approximately 5-15% of the stand. The shrub and herbaceous components are typically less than 10%. The mix of size classes over these mixed conifer community types and percent of the 30-45% tree canopy closure will be:

Size Class DBH	Percent of Total Tree Cover
1–6"	3–7%
6–11"	3–7%
11–18"	5–9%
18–25"	5–9%
25–30"	5–9%
30–40"	15–35%
40"+	20–40%

Forest structure is a combination of small, single-layered, even-aged groups of trees and small, uneven-aged, multi-layer, multi-species groups of trees. When viewed as a whole, these groups combine to provide continuous forest cover with a wide range of structural diversity.

The snag component is typically 4 to 6 snags per acre, 8 to 10 logs per acre contribute to the down woody debris, and the duff thickness is approximately 1-3" covering 30-70% of the ground. Bare ground is less than 10%.

The sites of higher quality/higher elevation typically have tree canopy closures of 30-40%. Jeffrey Pine is dominant and white fir comprises approximately 5-15% of the stand. The primary difference between this group and the previous group is the stature. The trees are much shorter and the size classes as a result are smaller. The shrub and herbaceous components are typically less than 10%. The mix of size classes over these mixed conifer community types and percent of the 30-40% tree canopy closure will be:

Size Class DBH	Percent of Total Tree Cover
1–6"	5–15%
6–11"	5–15%
11–18"	15–40%
18–25"	15–40%
25–30"	trace
30–40"	trace
40"+	absent

Forest structure is a combination of small, single-layered, even-aged groups of trees and small, uneven-aged, multi-layer, multi-species groups of trees. When viewed as a whole, these groups combine to provide continuous forest cover with a wide range of structural diversity.

The snag component is typically 4 to 6 snags per acre, 8 to 10 logs per acre contribute to the down woody debris, and the duff thickness is approximately 1-3" covering 30-70% of the ground. Bare ground is less than 10%.

The sites of lower quality typically have tree canopy closures of 10-30% and a total vegetative cover of 20-45%. Jeffrey Pine is dominant and white fir comprises approximately 5-15% of the stand. The mix of size classes over these mixed conifer community types and percent of the 10-30% tree canopy closure will be:

Size Class DBH	Percent of Total Tree Cover
1–6"	3–7%
6–11"	3–7%
11–18"	5–9%
18–25"	5–9%
25–30"	5–9%
30–40"	15–35%
40"+	20–40%

The shrub and herbaceous species are important components contributing 15-35% to the total vegetative cover within this third mixed conifer group. The shrub species will vary depending on the environmental parameters of the site. Manzanita, California lilac, or snowberry will be the dominant shrubs on the more mesic, cooler sites. Sagebrush and/or bitterbrush will be the dominant shrubs on the hotter or drier sites. The herbaceous vegetation will contribute 5-10% of the total vegetative cover and will be comprised of at least 10 different species such as squirrel tail, stipas, Ross' sedge, buckwheats, mustards and gayophytums.

Forest structure is more open, but still dominated by a mix of even-aged and uneven-aged groups of trees. The snag component is typically 4 to 6 snags per acre, 8 to 10 logs per acre contribute to the down woody debris, and the duff thickness is approximately 1" covering 15-25% of the ground. Bare ground is 20-35%.

Fires occur frequently in this vegetation series, and serve as the primary process influencing vegetation composition, species mix, and down woody debris.

Size	Intensity	Frequency	Fuel Load
0–200 acres	Low–Mod	10–25 years	20–40 tons/acre

Lodgepole Series

Lodgepole Riparian Subseries. This subseries was divided into three groups based on elevation and year round availability of surface water. The higher elevation group is within the same elevation zone as the red fir/lodgepole subseries and located along perennial surface water. The desired condition for this lodgepole riparian group will be to have a total vegetative cover of 70-85% comprised of trees, shrubs, and herbaceous vegetation. The mix of tree size classes over this lodgepole riparian community will be:

Size Class DBH	Percent of 25–35% Tree Canopy Closure
1–6"	5–15%
6–11"	5–15%
11–18"	5–15%
18–25"	20–30%
25–30"	20–30%
30–40"	5–15%
40"+	5–15%

Lodgepole is the dominant tree in this stand and is well represented in all size classes. Aspen is the next dominant and is well represented in the first four size classes. Red fir may be found contributing less than 2% to the tree canopy closure.

The shrubs are a key biodiversity component of this lodgepole riparian group and contribute 15-25% to the total vegetative cover. Willow species of various age classes are the dominate shrubs. The herbaceous component is made up of mesophytes and hydrophytes contributing 15-25% to the total vegetative cover.

The snag component is typically 4 to 6 snags per acre and 8 to 10 down logs per acre contribute to the down woody debris. Bare ground is less than 10%.

The lower elevation group is found outside the red fir/lodgepole subseries zone and is located along perennial surface water. The desired condition for this lodgepole riparian group will be to have a total vegetative cover of 70-85% comprised of trees, shrubs, and herbaceous vegetation. The mix of tree size classes over this lodgepole riparian community will be:

Size Class DBH	Percent of 15–25% Tree Canopy Closure
1–6"	5–10%
6–11"	5–15%
11–18"	5–15%
18–25"	10–20%
25–30"	10–20%
30–40"	5–10%
40"+	5–10%

Lodgepole is the dominant tree in this stand and is well represented in all size classes. Aspen is the next dominant and is well represented in the first four size classes.

The shrubs are a key biodiversity component of this lodgepole riparian group and contribute 20-35% to the total vegetative cover. Willow species of various age classes are the dominate shrubs. The herbaceous component is made up of mesophytes and hydrophytes contributing 20-35% to the total vegetative cover.

The snag component is typically 4 to 6 snags per acre and 8 to 10 down logs per acre contribute to the down woody debris. Bare ground is less than 10%.

The third lodgepole riparian group is found along ephemeral stream corridors. Dry Creek would be an example. The desired condition for this lodgepole riparian group will be to have a tree canopy closure of 25-35%. Lodgepole is the dominant species. The shrub and herbaceous species are typically less than 5%. The mix of tree size classes over this lodgepole riparian community will be:

Size Class DBH	Percent of 25–35% Tree Canopy Closure
1–6"	3–7%
6–11"	3–7%
11–18"	5–9%
18–25"	5–9%
25–30"	5–9%
30–40"	15–35%
40"+	20–40%

The snag component is typically 4 to 6 snags per acre and 8 to 10 down logs per acre contribute to the down woody debris. Duff thickness is approximately 1.5" covering 60-80% of the ground. Bare ground is less than 10%.

Fire occurrence in the riparian area is generally low, and would normally be associated with fires burning into the riparian area from surrounding areas. Due to the generally moister conditions associated with the riparian zone, fire intensity is usually low, and riparian areas frequently stop the spread of fires that do occur in adjacent areas. An infrequent, high intensity fire could occur within these areas during extended droughts.

Lodgepole Non-Riparian Subseries. This subseries was divided into two groups as a result of site quality. The desired condition is described for areas of high site quality and areas of low site quality.

The sites of higher quality typically have tree canopy closures of 15-30%, however the higher canopy cover would only be reached in the larger size classes. The shrub and herbaceous components are typically less than 5%. The mix of size classes over these lodgepole pine community types and percent of the 15-30% tree canopy closure will be:

Size Class DBH	Percent of 15–30% Tree Canopy Closure
1–6"	3–7%
6–11"	3–7%
11–18"	5–9%
18–25"	5–9%
25–30"	15–30%
30–40"	20–40%
40"+	Trace

The snag component is typically 3 to 5 snags per acre, 8 to 10 logs per acre contribute to the down woody debris, and the duff thickness is approximately 1-3" covering 40-70% of the ground.

The sites of lower quality typically have tree canopy closures of 5-15%. The shrub and herbaceous components are typically less than 5%. Trees are short, less than 60 feet in height. The mix of size classes over these lodgepole pine community types and percent of the 5-15% tree canopy closure will be:

Size Class DBH	Percent of 5–15% Tree Canopy Closure
1–6"	3–7%
6–11"	3–7%
11–18"	5–9%
18–25"	15–35%
25–30"	20–40%
30–40"	Trace
40"+	Absent

The snag component is typically 2 to 4 snags per acre, 8 to 12 logs per acre contribute to the down woody debris, and the duff thickness is approximately 1/2" covering 15-25% of the ground.

Fires occur with moderate frequency in this series. Fire intensity is generally low due to the lower fuel loads and discontinuous nature of the fuel. Although the overall fire intensity is low, there may small areas of high intensity fires associated with concentrations of fuels.

Size	Intensity	Frequency	Fuel Load
0–50 acres	Low	20–30 years	10–30 tons/acre

Jeffrey Pine Series

The desired condition for the series is divided into two components based on forest structure and stand density. The first component is characterized by small, single-layer, even-aged groups of trees. There would be a distribution of age and size classes between groups of trees. Stand density would be 15 to 30%, however the higher densities would only be reached in the larger size classes. Openings will be less than two acres in size. The forest would appear to be dominated by open stands of large trees mixed with patches of smaller, younger trees. The distribution of size classes within this Jeffrey pine community will be:

Size Class DBH	Percent of Series
1–6"	3–7%
6–11"	3–7%
11–18"	7–9%
18–25"	7–9%
25–30"	10–20%
30–40"	15–30%
40"+	20–40%

The snag component is typically 2 to 4 snags per acre and 3 to 5 down logs per acre contribute to the down woody debris, and duff thickness is approximately 1" covering 20% of the ground. Bare ground is less than 20%.

The second component would apply to 15% of the Jeffrey pine series. This component has a greater area covered by 6 to 11 inch size class trees, and the stand density of these areas is greater, ranging from 30 to 40%. The area covered by larger size classes will be less. The purpose of this is to provide greater wildlife habitat diversity through increased stand diversity. The mix of size classes over this Jeffrey pine community will be:

Size Class DBH	Percent of Series
1–6"	3–7%
6–11"	10–15%
11–18"	7–9%
18–25"	7–9%
25–30"	10–15%
30–40"	15–30%
40"+	10–20%

The snag component is typically 2 to 4 snags per acre and 3 to 5 down logs per acre contribute to the down woody debris, and duff thickness is approximately 1" covering 20% of the ground. Bare ground is less than 20%.

The total vegetation canopy within the two scenarios will be 30-55% with shrubs contributing 20-40% to the total vegetation canopy closure. The shrub species will vary depending on the environmental parameters of the site. Manzanita and California lilac will be the dominant shrubs on the more mesic, cooler sites. Mountain Mahogany, sagebrush and/or bitterbrush will be the dominant shrubs on the hotter or drier sites. The herbaceous vegetation will contribute 5-10% of the total vegetative cover and will be comprised of at least 10 different species such as squirrel tail, stipas, Ross' sedge, buckwheats, mustards and gayophytums.

Fires occur very frequently in this vegetation series, and serve as one of the processes influencing vegetation composition, species mix, and down woody debris. Although the overall fire intensity is low, there may small areas of high intensity fires.

Size	Intensity	Frequency	Fuel Load
0–500 acres	Low	5–15 years	20–40 tons/acre

Aspen Series

The total vegetation cover is 70-85%. Stands will be managed to provide the following mix of size classes:

Size Class DBH	Percent of 70–85% Tree Canopy Closure
1–6"	5–15%
6–11"	20–30%
11–18"	20–30%
18–25"	5–15%
25–30"	5–15%
30–40"	trace
40"+	trace

Other tree species may contribute no more than 5% to the total tree canopy closure.

Shrubs provide 10-20% cover of various age classes to the total vegetation cover and are an important biodiversity component. Snowberry is the dominant shrub with rabbitbrush, currents, sagebrush and bitterbrush contributing less than 5% cover. The herbaceous composition will contain a large number of species (greater than 10), and contribute 15-25% cover to the total.

The snag component is typically 10 to 12 snags per acre and 10 to 12 down logs per acre contribute to the down woody debris. Duff/litter thickness is approximately 1" covering 35-55% of the ground. Bare ground is less than 10%.

Fire occurs with moderate frequency and low intensity in the vegetation series, and is the primary process affecting species composition.

Wet Meadow Series

Wet meadow systems are not predominant throughout the study area; however, three distinct locations contain hydric vegetation that are characteristic of wet meadow systems. The headwaters of upper Deadman Creek and upper Glass Creek along with the more notable Glass Creek Meadow are characterized by a vegetative cover of at least 90%, consisting of primarily sedges and willows. These areas are well vegetated although they contain areas that are naturally unstable. The Glass Creek Meadow area is highly diverse in its vegetative associations, with more than 150 species previously identified. Some species typically occurring with greater frequency in this vegetation series include: Carex sp., Trifolium sp., Deschampsia caespitosa, Juncus sp., Ranunculus alismifolius, Hordeum brachyanthrum and phleum alpinum among others.

Both the headwaters of Deadman Creek and Glass Creek are smaller riparian systems containing dense stands of willow and aspen canopy intermingled with Jeffrey pine. The area of hydric influence within these small riparian areas does not provide for extensive openings within the woody vegetation. The understory is comprised of 40% carex sp. with the remaining vegetation being equally divided between 40% grasses/forbs and 20% litter/duff.

Montane Chaparral Series

Montane Chaparral occurs in two places within the landscape. The first area is within openings created by disturbance. In these areas, montane chaparral will eventually be replaced by the next successional vegetation species, resulting in spatial shifts in distribution. The second area is comprised of rocky sites or steep slopes. Shrubs will provide 40 to 50% vegetative cover for these areas. Fire occurrence is tied to the fire occurrence in the surrounding vegetation series, and will vary greatly within this series.

Great Basin Sagebrush Series

The distribution of this series is fairly constant within the area. Vegetation cover ranges from 40 to 60%, dominated by sagebrush. Grass and forbes provide cover between 5 to 15%. There is an even distribution of size classes throughout the series, but the spatial distribution is characterized by large (30-100 acre) patches of even-aged vegetation. Fire occurs with moderate frequency but high intensity, and is the primary process affecting age class distribution. Fires frequently burn into the sagebrush from the surrounding forest.

Wildlife. The vegetation patterns within the landscape provide diverse, connected, habitat components for a wide range of species. Migration corridors for deer are free of barriers.

Fisheries. Aquatic habitat consists of cold water streams and springs free of fish, cold water streams with self-sustaining populations of fish that colonized the area from past stocking, and cold water streams with fish populations supplemented with stocking. The extent of colonized reaches varies in response to changes in stream channels due to flooding, landslides, avalanches, and debris jams. Fish stocking will only occur near Glass Creek and Deadman Creek campgrounds. Stocking levels are low.

Substrate embeddedness ranges from 20 to 58% at designated sample stations. Until more data is available, the desired condition is to not increase embeddedness levels beyond the current levels at the sample stations. Percent pool area coverage by fine sediment varies from 5 to 40% at designated sample sites. Until more data is available, the desired condition is to not increase fine sediment coverage in pools beyond the current levels at the sample stations.

Amphibians. Habitat with known populations of amphibians is maintained. Potential habitat is surveyed to determine the presence of amphibians. Reaches of Deadman Creek above fish migration barriers are monitored for trout absence, so that potential impacts to amphibian habitat from trout invasion will be detected as early as possible.

Social Components

Heritage. All historic, prehistoric, and traditional properties are identified and evaluated. Significant properties are listed on the National Register of Historic Places and protected from damage.

Visual Resources. Activities within the area meet the Visual Quality Objective of Retention or Partial Retention as shown in figure 50.A1. Special emphasis is given to the visual landscape as seen from Highway 395 and the Scenic Loop Road.

Recreation Opportunity Spectrum. The Recreation Opportunity Spectrum (ROS) System is used to describe the social setting that visitors and users will encounter within the landscape. The description will also include specific activities and opportunities that will occur.

Visitors to the area find recreation opportunities that range from semi-primitive non-motorized to roaded natural. Rural settings are limited to the Mammoth Mountain Ski Area, the Glass Creek Recreation Area, and the Crestview Station area. Urban settings are limited to the area around the Mammoth Mountain Inn, Shady Rest Park, and private lands within the Town of Mammoth Lakes. The distribution of these opportunities are shown in figure 50.A2.

The following section describes the setting found in each of the areas.

Semi-Primitive Non-Motorized—The area is characterized as by predominantly natural-appearing landscapes. Visitors have a strong feeling of remoteness from more heavily used areas. Motorized vehicles are not allowed. Access is provided by trails, but much of the area can only be accessed by off-trail travel. Mechanized vehicles are allowed along designated trails. Mechanized or motorized equipment is allowed for resource management, although the use of motorized vehicles is limited. There are no permanent roads. Facilities are provided for resource protection.

This area will provide opportunities for hiking, hunting, fishing, off-track Nordic skiing, back-country alpine skiing, nature viewing/study, and mountain biking. Fa-

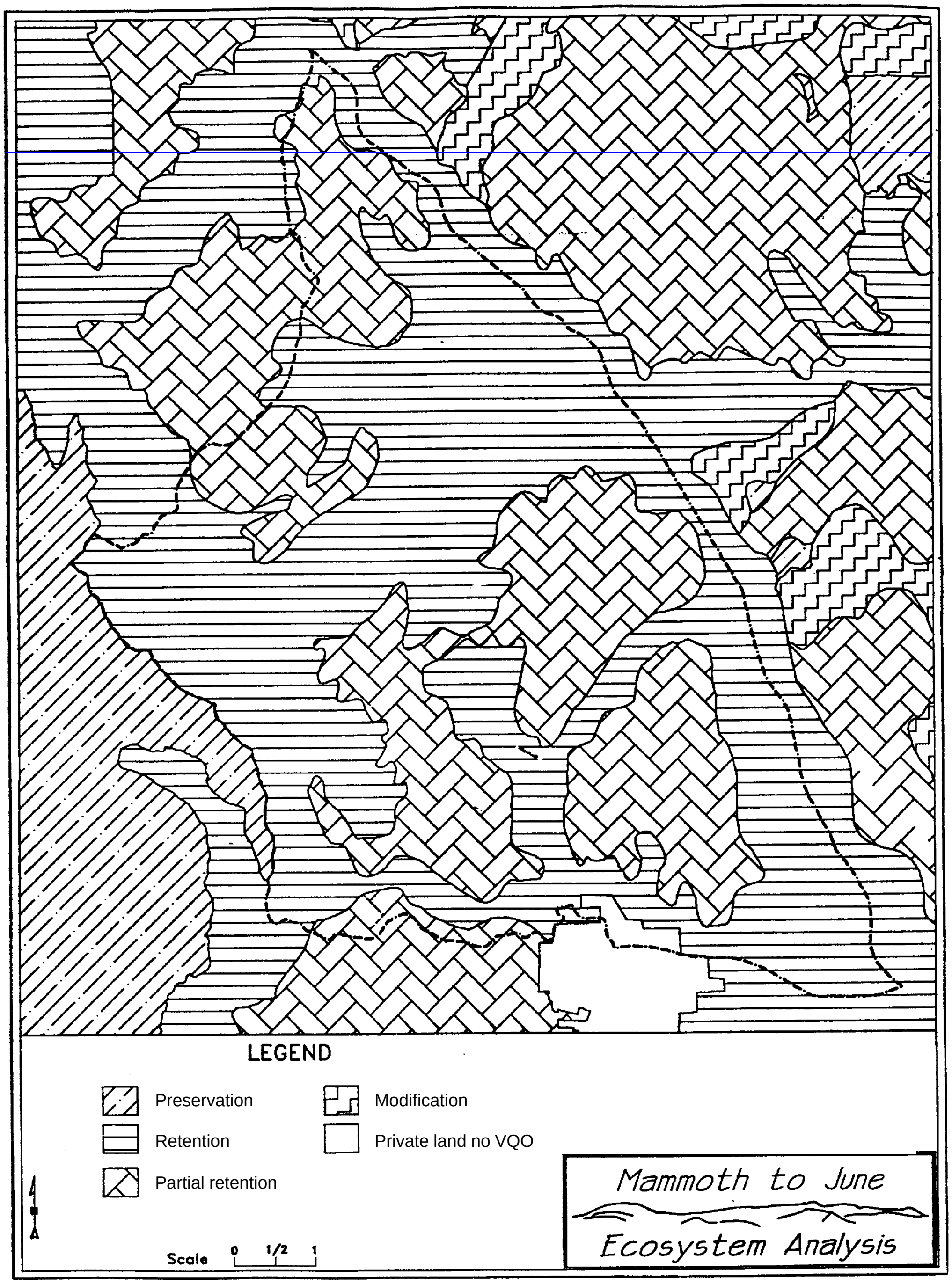


FIGURE 50.A1

Visual quality objectives.

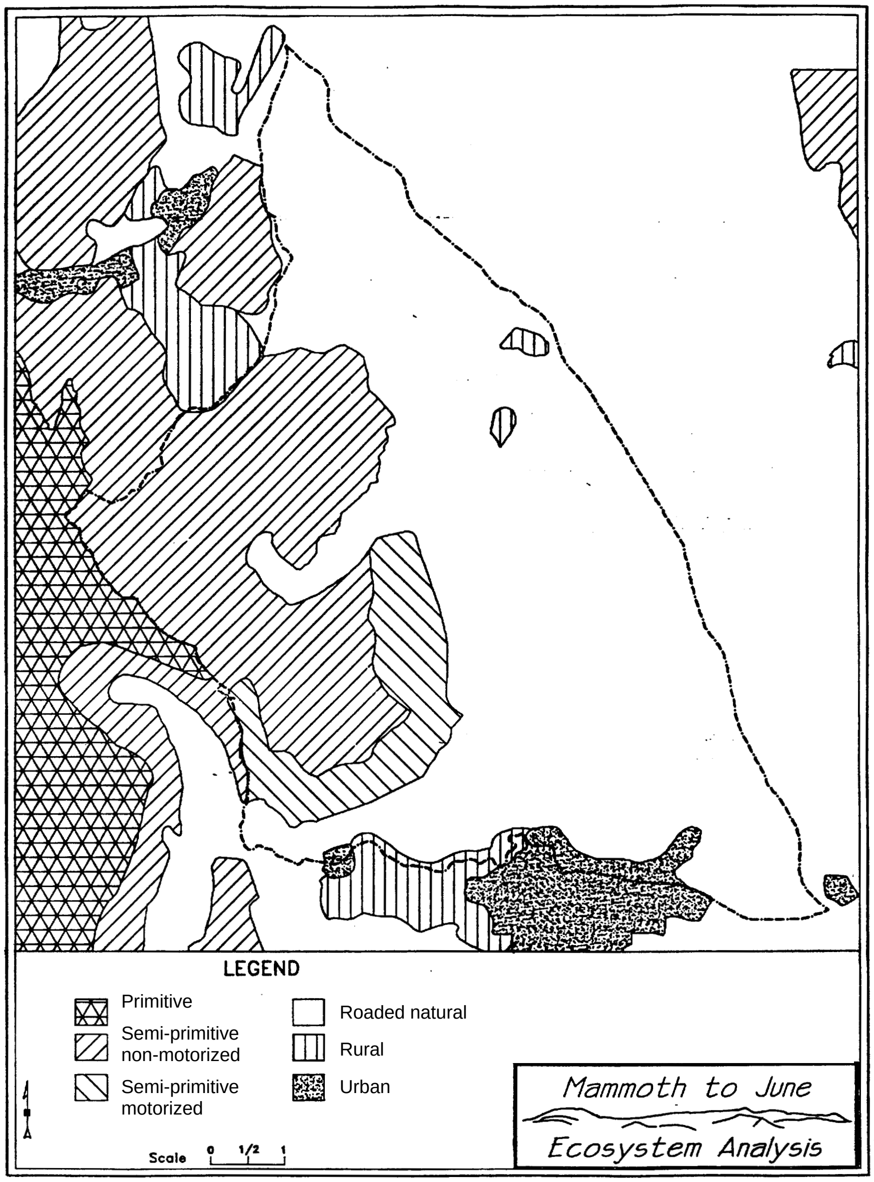
cilities to support these activities, such as parking and accessible rest rooms, will be outside of the area.

Semi-Primitive Motorized—The area is characterized as by predominantly natural-appearing landscapes. Visitors have a strong feeling of remoteness from more heavily used areas. Motorized vehicles are allowed along designated routes, but route density is low, usually less than 2 miles of routes per square mile of area. Facilities are provided for user safety and resource protection.

This area will provide opportunities for hiking, hunting, fishing, off-track and track Nordic skiing, back-country alpine skiing, nature viewing/study, mountain biking, snowmobiling, and off-highway or 4WD vehicle use. Facilities to support these activities, such as parking and accessible rest rooms, will be provided at concentrated use areas. Roads and parking areas are generally surfaced with native materials if surfaced at all.

FIGURE 50.A2

Desired ROS designations.



Roaded Natural—The area is characterized by a naturally appearing area with moderate evidence of the sights and sounds of humans. Roads and motorized vehicles are common to the area, with road density ranging from 3 to 6 miles of roads per square mile of area. Users may see evidence of a wide range of activities. Facilities are provided for user safety, convenience, and resource protection.

This area provides opportunities for the widest range of activities, including hiking, hunting, fishing, dispersed and developed site camping, viewing interpretive exhibits, OHV and 4WD vehicle use, mountain biking, Nordic and alpine skiing, snowmobiling, snowshoeing, dog sledding, snowplay and guided activities. Facilities such as parking and accessible rest rooms are provided to support these activities. Roads and parking areas can be surfaced for resource protection.

Rural—The sights and sounds of human activity are readily evident. Use levels are moderate. Highly developed facilities are provided for user safety, convenience, and resource protection.

Rural areas are limited to the area around Glass Creek Campgrounds and the Crestview Administrative site. The Glass Creek site is described in greater detail later in this document. Opportunities for other activities are generally associated with the camping use.

Urban—Urban areas are characterized by high levels of human activity and by concentrated development. Use levels can be very high. Developed sites are highly modified for specific activities.

Besides the private lands within the Town of Mammoth Lakes, only the Mammoth Mountain Inn and the Shady Rest Area are considered urban. In addition to providing specific uses like lodging or urban sports, both areas serve as starting points for dispersed recreation activities that occur throughout the landscape.

Roads and Trails. Access to the area is provided by an integrated system of roads and trails that accommodate motorized vehicles, mountain bikes, and foot traffic in both winter and summer. Travel loop opportunities are identified, and dead-end routes are limited. Motorized vehicles and mountain bikes are limited to designated routes in the summer, with off-road travel allowed in designated areas for specific purposes, such as fuel wood gathering. Snowmobile travel is allowed in designated areas.

Access routes are well signed, and information is available at key locations to inform visitors of opportunities and restrictions. Local partners take an active role in managing the access system, including assistance with signing, route maintenance, trail grooming, and use monitoring. Facilities are provided to support use of the access system throughout the year.

Existing Uses. The area supports a wide range of approved uses that are compatible with the Desired Condition.

Geothermal Development. Proposals to develop the geothermal resource are evaluated in accordance with geothermal lease conditions. Development proposals are designed to minimize conflicts with other uses in the area.

UPPER GLASS CREEK WATERSHED

Introduction

The Upper Glass Creek watershed area is located in the north central section of the Mammoth to June analysis area (figure 50.A3). It is bounded to the north by June Mountain, and to the south by White Wing. Glass Creek Meadow lies in the center of the area. Vegetation series within the basin include wet meadow, red fir/lodgepole, aspen, and sub alpine. Glass Creek is one of the primary tributaries to Deadman Creek and the Upper Owens River.

Desired Condition

The Upper Glass Creek watershed provides quality wildlife habitat appropriate for represented vegetation series as well as quality aquatic habitat associated with the streams and springs. Ecosystem processes such as fire, avalanches, and vegetation succession operate with little interference from humans or human activities. The sights and sounds of human activity are generally absent. Access to the area is provided by designated trails open to hikers or equestrians. These trails are connected to the integrated road and trail system accessing the area. Motorized vehicles or mountain bikes are not allowed in the majority of the basin, but transition points are provided so that travelers using motorized or mechanized transport can park and walk to Glass Creek Meadow. Facilities are constructed only for resource protection. Market resources (grazing, timber) are not expected as a byproduct of management activities, since the focus is on non-market resources such as solitude, wildlife habitat, and aquatic habitat.

Glass Creek Meadow is the keystone of the basin. The meadow is comprised of numerous springs and seeps throughout the meadow system with an associated stream channel supporting overhanging streambank vegetation in those locations where natural sloughing is limited. Vegetation varies slightly across the meadow zone from heavily hydric to marginally xeric near the meadow margins. The willow riparian vegetation occupies 80% of its natural streamside habitat. In the more hydric areas adjacent to springs there is an 80%/20% composition of sedges (carex sp.) to grasses and forbs. Within the more xeric sites, the vegetation is typically 40% carex sp., 20% grasses, 20% forbs and 20% bare ground. Of the 20% bare ground, 10% is undisturbed with litter in place and 10% contains some level of natural disturbance (sidehill erosion, gopher activity).

The stream channel supports self-sustaining populations of fish that were planted in the past. Plans to use Glass Creek as a recovery reach for Lahontain cutthroat trout have been modified to remove this area from the recovery plan. The upper reaches of Glass Creek provide aquatic habitat for Yosemite toads that includes slow moving and standing water with adjacent willow and aspen vegetation and talus slopes.

The upland areas around the meadow provide a diverse mosaic of red fir, lodgepole, aspen, and sub alpine forests. Fire, insect mortality, windthrow, and avalanches are the primary processes that influence vegetation composition and forest structure.

LOWER GLASS CREEK RECREATION AREA

Introduction

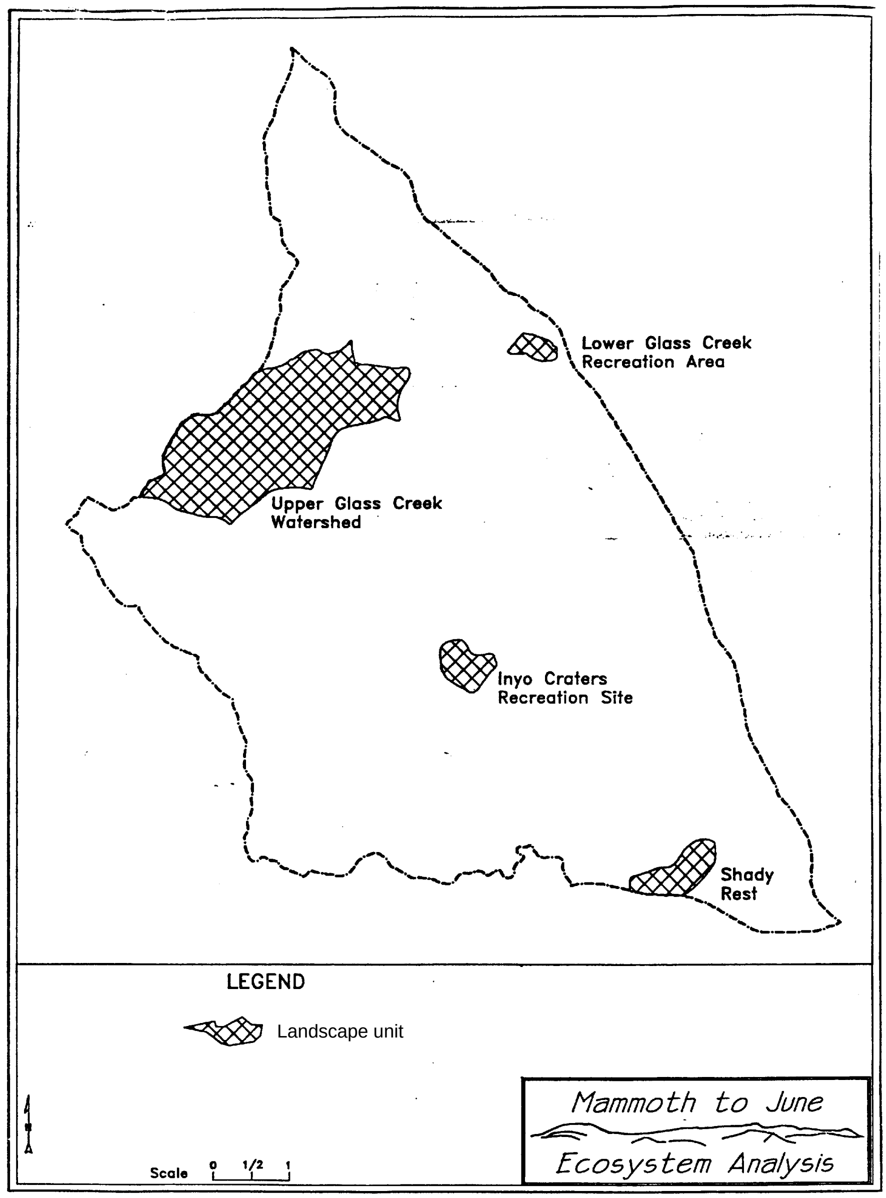
The Lower Glass Creek Recreation Area is located along Glass Creek, just above the confluence with Deadman Creek. It includes both sections of Glass Creek Campground, as well as the Glass Creek summer home tract. Vegetation is predominantly Jeffrey pine with some lodgepole.

Desired Condition

The Glass Creek Recreation area is divided into three clearly designated areas. Glass Creek #1 is located east of Glass Creek and north of the access road, and consists of a developed camp-

FIGURE 50.A3

Landscape units.



ground. Glass Creek #2 is west of Glass Creek and south of the access road, and consists of a developed campground. Glass Creek #3 is west of Glass Creek and north of the access road, and includes the recreation residence tract.

Glass Creek #1—The campground provides short term tent, car, or motorhome camping opportunities in designated spots. Access roads are paved and campsites clearly designated. Potable water is provided throughout the campground. Toilet facilities have flush toilets. Campsites are set back 100 feet from Glass Creek. The campground has between 75 and 125 designated sites. Numerous sites are designed to be universally accessible. All toilets are accessible.

Glass Creek #2—The campground provides long term tent, car, or motorhome camping opportunities. Access roads and campsites are clearly defined. Campsites are designed to accommodate a mix of individual and group camping arrangements. Campsites are set back 100' from Glass Creek. Vault toilets meeting the "Sweet Smelling Toilet" standard are accessible to all users. Potable water is provided at the toilet building for maintenance and for campers.

Glass Creek #3—The summer homes provide private recreation opportunities to families with permits. There are no changes proposed for this area.

Vegetation in all three areas is managed for forest conditions dominated by open stands of large trees. Hazard trees are be removed for public safety. Small patches of younger trees are established to provide future replacement trees and provide visual screening and diversity. The Glass Creek riparian area is managed to balance access for fishing with a functioning riparian corridor.

INYO CRATERS RECREATION SITE

Introduction

The Inyo Craters Developed Recreation Site is located north of the Town of Mammoth Lakes within the Dry Creek watershed. As implied by the name, the area is dominated by two small volcanic craters and a volcanic cinder cone. The developed recreation site includes an unsurfaced parking area and access road, an outhouse, a hiking trail, cross country ski trails, snowmobile trails, and the start and finish sections of a mountain bike loop trail. The primary attractions are the craters and the forest that surrounds them.

Vegetation is composed of dense multi-aged stands of Jeffrey Pine and Red Fir. The stands are characterized by scattered large trees over 250 years in age, mixed with dense clumps of smaller pine and fir trees under 100 years of age.

Desired Condition

Management of the area enhances the recreational values and opportunities associated with the craters and surrounding forest. Facilities and opportunities will accommodate large numbers of people safely, conveniently, and with little resource damage. Other activities are occurring but they are secondary to the recreational values and do not detract from them.

Summer opportunities include the chance to hike to the craters or start a mountain bike trip on established trails. Winter opportunities include the chance to ski or snowmobile to the craters on established trails. Information on the geologic features and the surrounding forest is available to visitors during both seasons. Parking is provided in the summer and accessible toilets that meet the "Sweet Smelling Toilets" standards are available all year. A safe viewing area is provided for visitors at the rim of the craters. The access road and parking area have stable surfaces that will accommodate light trucks and passenger cars. The parking area includes adequate controls to confine vehicles to the parking area and avoid adverse effects from uncontrolled vehicle use. Established trails have stable surfaces that provide easy access to the crater rim; however, people with disabilities will find the trail access challenging. Trails are constructed and maintained in a manner that discourages off trail use thus minimizing the formation of multiple user trails. All facilities meet the Recreational Opportunity Spectrum guidelines for roaded natural. Interpretative signing will focus on vegetation management along the trail and geologic processes at the crater rim.

Vegetation management promotes forest conditions that increase resistance to insect and disease attacks, reduce the susceptibility to catastrophic fire, and provide an aesthetic visual appearance. The majority of the area is characterized by scattered large trees with open understories. Tree density ranges from 10 to 20 large (>32") trees per acre. Small patches (1 to 2 acres) of younger, smaller trees are scattered throughout the forest to create a fine textured matrix. This matrix provides for forest diversity as well as visual complexity and variety. Basal area of most stands will range between 120 to 160 sq.ft./acre, with some isolated pockets of higher density stands with basal areas ranging up to 210 sq.ft./acre. Snag density ranges from 2 to 3 snags per acre, with snag location managed so that hazards are reduced along trails and near facilities. Dead and down material is present at low density, with 1 to 2 large downed logs per acre. Ground cover is composed primarily of needle cast and fine litter, and exposed soil is only found along roads, trails, and in association with rock outcrops or pumice flats.

SHADY REST

Introduction

The Shady Rest area includes the Mammoth Ranger Station, the Mammoth FS administrative site, the Shady Rest Campground complex, the Sawmill road parking area, and the Shady Rest Community Park. These areas are immediately adjacent to the Town of Mammoth Lakes, and receive considerable use from visitors and the community. The areas are located within a Jeffrey pine forest.

Desired Condition

The area serves large numbers of people safely and conveniently during all seasons. Summer opportunities include camping, viewing interpretive displays, attending interpretive programs, walking, hiking, and biking. The community park offers playground activities for all visitors and team sport activities for local residents. The park also supports special events. All activities at the park are limited to daylight hours. The limits of the campground, administrative site, and community park have not expanded.

Winter opportunities include Nordic skiing on groomed trails, snowmobiling, dog sledding, snowshoeing, other snowplay activities, and interpretive activities. Because the area is fairly confined, some use restrictions are enforced to avoid user conflicts. Parking and toilets are provided in the winter to support these users.

ACKNOWLEDGMENTS

This appendix was written by Robert Hawkins, team leader, and the Inyo National Forest Mammoth-June Analysis Team.

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